

TIME

The Animal Mind

What they're thinking and feeling,
and how to understand them



By Jeffrey Kluger

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What's on their minds?

Let's be honest: you'd rather die than wake up tomorrow morning and find out you'd turned into an animal. There's a certain dignity and inevitability about dying, after all. Shakespeare did it, Einstein did it, Galileo and Washington and Twain all did it. And you, someone who was born a human and will live your life as a human, will end your life that way too.

But living that life as an animal—an insensate brute, incapable of reason, abstraction, perhaps even feeling? Unthinkable. Yes, yes, the animals don't recognize the difference, and neither would you. If you're a goat, you possess the knowledge of a goat, and that can't be much. But there's more to it than that.

Human beings have always had something of a bipolar relationship with the millions of other species with which we share the planet. We are fascinated by them, often dazzled by them. They can be magnificently beautiful, for one thing: the explosive color and frippery of a bird of paradise, the hallucinatory variety of the fish in a coral reef, the otherworldly markings and architecture of a giraffe. Even the plain or ugly animals—consider the naked, leathery grayness of the rhino or elephant—have a certain solidity and equipoise to them. And to see an animal at what appears to be play—the breaching dolphin, the swooping raptor—is to think that it might be fun to have a taste, a tiny taste, of their lives.

But it's a taste we'd surely spit right out, because as much as we may admire animals, we pity them too: their ignorance, their in consequence, and their brief, savage lives. It's in our interest to see them that way. Not so much because we need to press our already considerable advantage over them; we don't. But because we have certain uses in mind for them. We need the animals to work for us—to pull carts, drag plows, lift logs and carry loads, and stand still for a whipping if

they don't. We need them to entertain us, in our circuses and zoos and stage shows. And most of all, we need them to feed us, with their eggs and milk and their very flesh. So it's best to conclude that they don't much mind because they don't much notice, and to the extent that they do, their suffering is as crude and fleeting as their entire lives. A few favored beasts do get a pass—dogs, cats, some horses—but the rest are little more than tools for our use.

But that view is becoming impossible to sustain. The more deeply scientists look into the animal mind, the more they're discovering it to be a place of richness, joy, thought and even nuance. There are the parrots that don't just mimic words but appear to understand them, for example, assembling them into what can only be described as sentences. There are the gorillas and bonobos that can do the same with sign language or pictograms. Those abilities are hard to dismiss, but they also miss the point; they are, in some ways, parlor tricks, animals doing things humans do, but much less well.

A better measure is the suite of behaviors the animals exhibit on their own: crows that can fashion tools, lions that collaborate on elaborate hunts, dolphins and elephants with signature calls that serve as names, and cultural norms like grieving for their dead and caring for grandchildren. There are the complex, even political societies that hyenas create and the factory-like worlds of bees and ants. There are the abiding friendships among animals, too—not just the pairs of dolphins or horses or dogs that seem inseparable but the cross-species loyalties: the monkey and the dog, the sheep and the elephant, the cat and the crow, members of ordinarily incompatible species that appear never to have thought to fight with or eat one another because, well, no one told them they had to.

Animals, the research is proving, are creatures capable of reflection, bliss, worry and more. Not all of them in the same ways or to the same degrees, surely, but all of them in far deeper measures than we've ever believed. The animal mind is nothing like the wasteland it's been made out to be. And if it's not the mind you'd want to have as your own, it's one that is still worth getting to know much better.



Animals have brains, but do they have minds?

Not long ago, I spent the morning having coffee with Kanzi. It wasn't my idea; Kanzi invited me, in his customary clipped way. Kanzi is a fellow of few words—384 of them by formal count, though he probably knows dozens more. He has a perfectly serviceable voice—very clear, very expressive and very, very loud. But it's not especially good for forming words, which is the way of things when you're a bonobo, the close and more peaceable cousin of the chimpanzee.

But Kanzi is talkative all the same. For much of his day, he keeps a sort of glossary close at hand—three laminated, place-mat-like sheets filled with hundreds of colorful symbols that represent all the words he's been taught by his minders or picked up on his own. He can build thoughts and sentences, even conjugate, all by pointing. The sheets include not just easy nouns and verbs like *ball* and *Jell-O* and *run* and *tickle* but also concept words like *from* and *later* and grammatical elements like the *-ing* and *-ed* endings signifying tense.

Kanzi knows the value of breaking the ice before getting down to business. So he points to the coffee icon on his glossary and then points to me. He then sweeps his arm wider, taking in primatologist Sue Savage-Rumbaugh, an investigator at the Great Ape Trust—the research center in Des Moines,



GIFT OF GAB
At the Great Ape Trust in Des Moines, Kanzi, a bonobo, has been taught to communicate in complex ways.

1 INTELLIGENCE

Iowa, that Kanzi calls home—and lab supervisor Tyler Romine. Romine fetches four coffees (hot, but not too hot), takes one to Kanzi in his patio enclosure on the other side of a Plexiglas window and then rejoins us. Kanzi sips—gulps, actually—and since our voices are picked up by microphones, he listens as we talk.

"We told him that a visitor was coming," Savage-Rumbaugh tells me. "He's been excited, but he was stubborn this morning, and we couldn't get him to come out to the yard. So we had to negotiate a piece of honeydew melon in exchange." Honeydew is not yet on Kanzi's word list; instead, he points to the glyphs for green, yellow and watermelon. When he tried kale, he named it "slow lettuce" because it takes longer to chew than regular lettuce.

The not-for-profit Great Ape Trust is home to six bonobos, including Kanzi's son Teco, born in 2010. Kanzi is by no means the first ape to have been taught language. The famous Koko, Washoe and others came before him. But the Trust takes a novel approach, raising apes from birth with spoken and symbolic language as a constant feature of their days. Just as human mothers take babies on walks and chatter to them about what they see even though the child does yet not understand, so too do the scientists at the Trust narrate the lives of their bonobos. With the help of such total immersion, the apes are learning to communicate better, faster and with greater complexity.

Today, though, Kanzi is not interested in saying much, preferring to run and leap and display his physical prowess instead. "Ball," he taps on one of his glossary sheets when he finishes his coffee.

"Tell him you'll get it for him," Savage-Rumbaugh instructs me and then shows me where the necessary symbols are on a sheet I have in hand. "Yes-I-will-chase-the-ball-for-you," I slowly peck out, *chase* being a word Kanzi uses interchangeably with *get*.

It takes me a while to find the ball in an office down the hall, and when I finally return, Savage-Rumbaugh verbally asks Kanzi, "Are you ready to play?" He looks at us balefully. "Past ready," he pecks.

Humans have a fraught relationship with

Talking with apes

Fluent in at least 384 icons, the Iowa bonobos can also build new ideas from old ones



Slow + Lettuce = Kale

It takes a long time to chew kale, so Kanzi named it accordingly.



Feel + Kiss + Eat = Candy

As a baby, Nyota, another male, liked eating candy and getting kisses. Later, he figured out how to ask for it.



Big + Water = Flood

After flooding in Iowa, the bonobos invented a term for what they'd seen.



Bread + Cheese + Tomato = Pizza

They know what they like, and what they like is pizza. Now they can request it.

FIRE UP

Kanzi arranges sticks, lights them, cooks food and extinguishes a campfire. The ape's talents with tools and language bolster a growing movement to acknowledge animal intelligence, which may not diverge from that of humans as much as previously thought.



beasts. They are our companions and our chattel, our family members and our laborers, our household pets and our household pests. We love them and cage them, admire them and abuse them. And, of course, we cook and eat them.

Our dodge—a not unreasonable one—has always been that animals are ours to do with as we please simply because they don't suffer the way we do. They don't think, not in any meaningful way. They don't worry. They have no sense of the future or their own mortality. They may pair-bond, but they don't love. For all we know, they may not even be conscious.

"The reason animals do not speak as we do is not that they lack the organs," René Descartes once said, "but that they have no thoughts." For many people, the Bible offers the most powerful argument of all. Human beings were granted "dominion over the beasts of the field," and there the discussion can more or less stop.

But one by one, the berms we've built between ourselves and the beasts are being washed away. Humans are the only animals that use tools, we used to say. But what about the birds and apes that we now know do as well? Humans are the only ones who are empathetic and generous, then. But what about the monkeys that practice charity and the elephants that mourn their dead? Humans are the only ones who experience joy and a knowledge of the future. But what about the British study showing that pigs raised in comfortable environments exhibit optimism, moving expectantly toward a new sound instead of retreating warily from it? And as for humans as the only beasts with language? Kanzi himself could tell you that's not true.

All of that is forcing us to look at animals in a new way. With his 1975 book *Animal Liberation*, bioethicist Peter Singer of Princeton University launched what became known as the animal-rights movement. The ability to suffer, he argued, is a great cross-species leveler, and we should not inflict pain on or cause fear in an animal that we wouldn't want to experience ourselves. This idea has never met with universal agreement, but new studies are giving it more legitimacy than ever. It's not enough to study an animal's brain, scientists now say; we need to know its mind.

Conscious Critters

There are many obstacles in the way of our understanding animal intelligence, not the least being that we can't even agree whether non-human species are conscious. We accept that chimps and dolphins experience awareness; we're certain dogs and cats do. But what about mice and newts? What about a fly? Is anything going on there at all? A tiny brain in a simple animal has enough to do just controlling basic bodily functions. Why waste synapses on consciousness if the system can run on autopilot?

There's more than species chauvinism in that question. "Below a certain threshold, it's quite possible there's no subjective experience," says cognitive psychologist Dedre Gentner of Northwestern University. "I don't know that you need to ascribe anything more to the behavior of a cockroach than a set of local reflexes that make it run away from bad things and toward good things."

Where that line should be drawn is impossible to say, since our judgment is clouded by our feelings about any given species. A cockroach most likely has no less brainpower than a butterfly, but we're quicker to deny it consciousness because it's a species we dislike. Still, most scientists agree that awareness is probably controlled by a sort of cognitive rheostat, with consciousness burning brightest in humans and other high animals and fading to a flicker, and finally blackness, in very low ones.

"It would be perverse to deny consciousness to mammals," says Steven Pinker, a Harvard psychologist and the author of *The Stuff of Thought*. "Birds and other vertebrates are almost certainly conscious too. When it gets down to oysters and spiders, we're on shakier ground. Of course, a lot depends on what you mean by consciousness, but basic experiences like seeing red or tasting salt or enjoying sex or all the other components of being awake and aware are things we certainly share with animals that have similar brains."

Other investigators are a bit more dismissive of the whole idea. "I shared a stage with one of the leading bee researchers, and he was waxing poetic about bee consciousness," says Colin Allen, who teaches history and philosophy of science at Indiana University. "I'm not ready to go there. What I would think would be good evidence of consciousness would be some ability for animals



Crows and other corvids excel at tool use, a function of both clever brain wiring and the birds' complex social structure.

Orangutans have such a strong sense of the difference between self and other that they will preen at their own reflection.



to know they've made a mistake, to self-correct."

While the idea of animals as automata does not sit well with everyone, it's worth remembering that even human beings have periods of performing both basic and very complex functions with absolutely no awareness that we're doing it. Think of how many times you've driven 20 miles on a highway while your mind wandered aimlessly, never considering the constant stream of visual, auditory, spatial and tactile stimuli you had to process on an instant-by-instant basis just to keep moving safely in a two-ton hunk of metal going 60 miles an hour. Admittedly, this is not true unconsciousness, since your drifting mind was surely occupied by something, but whatever that something was, it wasn't the task at hand. That was managed by you, the human automaton.

Among animals aware of their existence, intellect falls on a sliding scale just as consciousness does, and in this case that scale is often

region of the brain and one that many animals lack. Mammals are members of the cerebral-cortex club, and as a rule, the bigger and more complex that brain region is, the more intelligent the animal. But it's not the only route to creative thinking. Consider tool use. Humans are magicians with tools, apes dabble in them, and otters have mastered the task of smashing mollusks with rocks to get the meat inside—which, though primitive, counts. (There was once even an account of an adult elephant that flung a baby elephant at a locked gate in an attempt to open it. For better or worse, the baby was the tool in that particular arrangement.) But if creativity lives in the cerebral cortex, why are corvids, the class of birds that includes crows and jays, better tool users than nearly all nonhuman species?

Crows, for example, have proved themselves adept at bending wire to create a hook so they can fish a basket of food from the bottom of a

seen as a function of brain size. Here humans like to think they're kings. The human brain is a big one—about 3 pounds. But the dolphin brain weighs up to 3.75 pounds, and the killer whale carries a monster-size 12.3-pound brain. We're smaller than the dolphin and much smaller than the whale, however, so correcting for body size, we're back in first, right? Nope. The brain of the Etruscan shrew weighs just 0.0035 ounce, yet relative to its tiny body, its brain is bigger than ours.

While the size of the brain certainly has some relation to smarts, much more can be learned from its structure. Higher thinking takes place in the cerebral cortex, the most evolved

plastic tube. More remarkably, in 2009 a zoologist at the University of Cambridge, the aptly named Christopher Bird, found that the rook, a member of the crow family, could reason through how to drop stones into a pitcher partly filled with water in order to raise the level high enough to drink from it. What's more, the rooks selected the largest stones first, apparently realizing they would raise the level faster. Aesop wrote a tale about a bird that managed just such a task more than 2,500 years ago, but it took 21st-century scientists to show that the feat is no fable.

How the birds performed such a stunt without a cerebral cortex probably has something to do with a brain region they do share with mam-

mals: the basal ganglia, more primitive structures involved in learning. Mammalian basal ganglia are made up of a number of structures, while those in birds are streamlined down to one. A collaborative team at MIT and the Hebrew University of Jerusalem found that while the specialized cells in each section of mammalian basal ganglia do equally specialized work, the undifferentiated ones in birds' brains multitask, doing all those jobs at once. The result is the same—information is processed—but birds do it more efficiently. "Bird brains may be structurally different from mammals' brains, but they nonetheless do mammalian things," says animal biologist Christine Drea of Duke University. "Clearly, they came up with another way to accomplish that."

In the case of corvids and other animals, what may drive intelligence higher still is the structure not of their brains but of their societies. It's easier to be a solitary animal than a social one. When you hunt and eat alone, like the polar bear, you don't have to negotiate power struggles or collaborate in stalking prey. But it's in that behavior that animals behave most cleverly.

Drea points to lions as the perfect example of the elegance of cooperation, particularly during the hunt. "Lions do very cool things," she says. "One animal positions itself for the ambush, and another pushes the prey in that direction." More impressive still is the unglamorous hyena. "A hyena by itself can take out a wildebeest, but it takes several to bring down a zebra," she says. "So they plan the size of their party in advance and then go out hunting particular prey. In effect, they say: Let's go get some zebras. They'll even bypass a wildebeest if they see one on the way."

In 2009, Drea published a study about hyena cooperation. Pairs of the animals were released into a pen in which two ropes dangled from an overhead platform. If the animals pulled the ropes in unison—and only in unison—the platform would spill out food. "The first pair walked into the pen and figured it out in less than two minutes," Drea says. "My jaw literally dropped."

But you don't have to be a complex animal like a lion or a hyena to work together; you don't even have to be the same species. A remarkable study out of the University of Neuchâtel in Swit-

zerland found that the lowly grouper and moray eel can forge an alliance of convenience when dinner is on the line. Groupers excel at hunting in open waters, something moray eels do only poorly and inefficiently. But the eels are great at slithering into crevices in reefs and flushing out prey, which the far less flexible grouper can't do at all. When the two combine their talents, however, prey have nowhere to hide and both hunters can eat their fill. There is even planning involved in the joint enterprise. Hungry groupers will sometimes get things going by approaching a crevice in which an eel is lurking and performing a distinctive head shake; the eels seem to understand the invitation, and if they accept it, the hunt is on.

Cooperation takes other forms too, often in ways involving communication. Orangutans may not have the linguistic smarts of bonobos, even if they share the great-ape category with them, but they can still trade ideas among themselves with a fair bit of nuance. All orangutans emit certain sounds when engaged in certain activities—nest-building, for instance—which is perhaps a way to signal to other members of the community that they don't want to be disturbed or that what they are making is theirs and is not supposed to be touched. Maybe that behavior is innate, but the sounds differ from community to community, with orangutans in one region making raspberry-like noises during nest-making and others making a sort of lip-smacking sound. These are like regional dialects, differences in language no different from a Southern drawl or an Irish brogue.

"This is a very strong indication that different sounds among wild populations are learned and are not purely genetically or ecologically based," said orangutan researcher Serge Wich in a statement that accompanied the release of the work. "This is a great indication that orangutans can learn sounds not in their repertoire."

For these kinds of animals, it's not clear what the cause-and-effect relationship of social grouping is—whether living cooperatively boosts intelligence or innate intelligence makes it easier to live cooperatively. It's certainly significant that corvids are among the most social of birds,



Elephants are very familial and appear to mourn their dead. If they find elephant bones, they gently examine the skull.



"It would be
perverse to deny
consciousness to
mammals."
— psychologist
Steven Pinker

with long lives and stable group bonds, and that they're the ones that have proved so handy. It's also significant that herd animals, like cows and buffalo, exhibit little intelligence. Though they live collectively, there's little shape to their society. "In a buffalo herd, Bob doesn't care who Betty is," Drea says. "But among primates, social carnivores, whales and dolphins, every individual has a particular place."

Self and Others

It's easy enough to study the brain and behavior of an animal, but subtler cognitive abilities are harder to map. One of the most important skills human children must learn is something called the theory of mind: the idea that not all knowledge is universal knowledge. A toddler who watches a babysitter hide a toy in a room will assume that anyone who walks in afterward knows where the toy is too. It's not until about age 3 that kids realize that just because they know something, it doesn't mean some-

body else knows it also.

The theory of mind is central to communication and self-awareness, and it's the rare animal that exhibits it, though some do. Dogs understand innately what pointing means: that someone has information to share and that your attention is being drawn to it so that you can learn too. That seems simple, but only because we're born with the ability and, by the way, have fingers with which to do the pointing.

Great apes, despite their impressive intellect and five-fingered hands, do not seem to come factory-loaded for pointing. But they may just lack the opportunity to practice it. A baby ape rarely lets go of its mother, clinging to her abdomen as she knuckle-walks from place to place. But Kanzi, who was raised in captivity, was often carried in human arms, and that left his hands free for communication.

"By the time Kanzi was 9 months old, he was already pointing at things," says Savage-Rumbaugh. I witnessed him do it in Iowa, not

only when he pointed at me to invite me for coffee but also when he swept his hand toward the hallway in a be-quick-about-it gesture as I went to get him his ball.

Pointing isn't the only indicator of a smart species that grasps the theory of mind. Blue jays, another corvid, cache food for later retrieval and are very mindful of whether other animals are around to witness where they've hidden a stash. If the jays have indeed been watched, they will wait until the other animal leaves and then move the food. They not only understand that another creature has a mind; they also manipulate what's inside it.

The gold standard for demonstrating an understanding of the self-other distinction is the mirror test: whether an animal can see its reflection and recognize what it is. It may be adorable when a kitten gets a look at itself in a full-length mirror and runs around to the other side of the door looking for what it thought was a playmate, but it's not head-of-the-class stuff. Elephants, apes and dolphins are among the few creatures that can pass the mirror test. All three respond appropriately when they look in a mirror after a spot of paint has been applied to their forehead or another part of their body. Apes and elephants will reach up to touch the mark with finger or trunk rather than reach out to touch the reflection. Dolphins will position themselves so they can see the reflection of the mark better.

"If you put a bracelet on an orangutan and put it in front of a mirror, it doesn't just look at the bracelet," says Bhagavan Antle, director of the Institute of Greatly Endangered and Rare Species in Myrtle Beach, S.C. "It puts the bracelet up to its face and shakes it. It interacts with its reflection."

With or without mirror smarts, some animals are also adept at grasping abstractions, particularly the ideas of sameness and difference. Small children know that a picture of two apples is more similar to a picture of two bananas than it is to a picture of an apple and a banana, because in the first two cases the objects match and in the third they don't. The same is true, though innately trickier, if kids are asked to reverse the concept—seeing the similarity between two pictures of non-matching objects—though they can master that fairly easily too.

"It's called relations between relations, and it's a basic scaffold of intelligence," says psychologist Ed Wasserman of the University of Iowa. In 2009, Wasserman conducted a study that proved that some animals have begun building that scaffold. In his research, baboons and, surprisingly, pigeons got the relations-between-relations idea, correctly identifying the proper pairings with a peck of a beak or a flick of a joystick when images were flashed on a screen.

Significantly, just as humans better understand an idea when they have a term to describe it (imagine explaining the differences between, say, "belief" and "conviction," or "peace" and "serenity" if the words that have come to capture those distinctions didn't exist), so do animals benefit from labeling. Psychologist David Premack of the University of Pennsylvania found that when chimps were taught symbols for *same* and *different*, they later performed better on analogy tests. That's the reason the bonobos' language sheets at the Iowa Trust increasingly include abstractions like "for," "to," "some" and "until"—all ideas Savage-Rumbaugh calls "non-point-at-able." And those pay off.

When one of the female bonobos made a pet out of a snake that occasionally wandered into the patio enclosure, Nyota, a language-adept male, used his symbol sheets to instruct Savage-Rumbaugh, "You be quiet for snake to come." It's possible Nyota would have understood that cause-and-effect relationship no matter what, but being able to express it could not have helped but strengthen his grasp.

Beyond Smarts

If animals can reason, even if it's in a way we'd consider crude, the unavoidable question becomes: Can they feel? Do they experience empathy or compassion? Can they love or care or hope or grieve? And what does that say about how we treat them? For science, it would be safest simply to walk away from a question so booby-trapped with imponderables. But science can't help itself, and some investigators are exploring these ideas too.

It's well established that elephants appear to mourn their dead, lingering over a herd-mate's body with what looks like sorrow. They

show similar interest—even what appears to be respect—when they encounter elephant bones, gently examining them, paying special attention to the skull and tusks. Apes also remain close to a dead troopmate for days. In 2006 a surreal, lying-in-state tableau took place at the Great Ape Trust when a male bonobo died of cancer. He was laid out on a table in the lobby, and the other animals were given time to look at him from the other side of their glass partition. None of the scientists would venture a guess as to what the bonobos were feeling, but the quiet, seemingly contemplative way they behaved was at least superficially consistent with the actions of mourning humans.

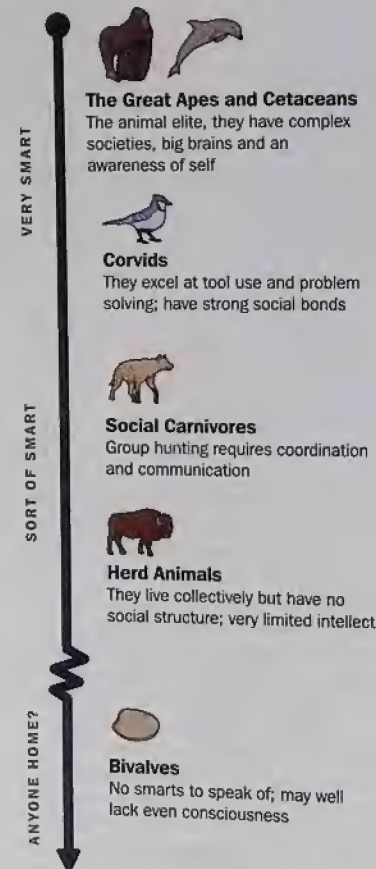
Empathy for living members of the same species is not unheard of, either. "When rats are in pain and wriggling, other rats that are watching will wriggle in parallel," says psychologist and anthropologist Marc Hauser, the author of *Moral Minds* and other books. "You don't need neurobiology to tell you that suggests awareness." A 2008 study by primatologist Frans de Waal and others at the Yerkes National Primate Research Center in Atlanta showed that when capuchin monkeys were offered a choice between two tokens—one that would buy two slices of apple and one that would buy one slice each for them and a partner monkey—they chose the generous option, provided the partner was a relative or at least familiar to them. The Yerkes team believes that the capuchins' behavior was partly out of a simple sense of pleasure they experience in giving, an idea consistent with studies of the human brain that reveal activity in the reward centers after subjects donate to charity.

Animal-liberationist Singer believes that such evidence of noble impulses among animals is a perfectly fine argument in defense of their right to live dignified lives, but it's not a necessary one. Indeed, one of his central premises is that to the extent that humans and animals can experience their worlds, they are equals. "Similar amounts of pain are equally bad," he says, "whether felt by a human or a mouse."

Hauser takes a more nuanced view, arguing that people are possessed of what he calls humaniqueness, a suite of four cognitive skills that animals just don't have: the ability to create new concepts and rules and combine them in

Who's the smartest?

Comparing animals' brainpower is still mostly guesswork, but very rough rankings are possible



different ways (the complex structures of grammar, music and math, for instance); the ability to mingle ideas across disciplines (the way statistics, causality and ethics allow us to make high-order moral decisions about, say, causing harm to a few in order to save many); the ability to create mental symbols, such as letters, numbers, musical notes and pictures; and the ability to contemplate abstractions. All creatures may exist on a developmental continuum, Hauser argues, but the gap between us and the second-place finishers is so big that it shows we truly are something different. "Animals have a myopic intelligence," Hauser says. "But they never experience the aha moment that a 2-year-old child gets."

No matter what any one scientist thinks of animal cognition, nearly all agree that the way we treat domesticated animals is often indefensible, though in certain parts of the world, improvements are being made. Roughly 360 million cattle, sheep, goats and pigs are slaughtered for meat in European Union countries every year, in addition to several billion chickens and other poultry. The E.U. has responded to that dark reality by adopting official animal-welfare policies that begin with the premise that animals are sentient beings and must be treated accordingly. This includes humane conditions on farms and in vehicles during transport and proper stunning before killing in slaughterhouses.

While those are welcome reforms, they sidestep the larger matter of whether we have any right to be doing the slaughtering at all. Even the E.U.'s supposedly acceptable methods for killing animals include electrical water baths, dislocation of the neck, and maceration—or whole-body crushing—a method used with chicks. After those, what exactly would be considered unacceptable?

In the U.S., food animals are overwhelmingly raised on factory farms, where cattle and pigs are jammed together by the thousands and chickens are confined in cages that barely allow them to stand. But here too, public sentiment is changing. Roughly half of all vegetarians list moral concerns as their chief reason for giving up meat. Still, vegetarians as a whole make up only about 3% of the U.S. population, a figure that has

barely budged since before the days of Singer's manifesto. And there are three times as many ex-vegetarians as practicing ones.

Even Singer doesn't believe we're likely to wake up in a vegan world anytime soon. For that matter, he doesn't think it's morally necessary. Eating meat to avoid starvation is all right, he believes, and some creatures are fair game all the time, provided they're grown sustainably. "I think there's very little likelihood that oysters, mussels and clams have any consciousness, so it's defensible to eat them," he says.

What's more, we're not going to quit using animals in other ways that benefit humans either—testing drugs, for example, though computer modeling and more precise testing are at least reducing the number of animals that have to be used. Regardless, we could surely stop using them to test cosmetics, a practice the E.U. is also moving to ban. We could surely eat less meat and treat animals better before we convert them from creature to dinner. And we could rethink zoos, marine parks and other forms of animal entertainment.

Ultimately, the same biological knob that adjusts animal consciousness up or down ought to govern how we value the way those species experience their lives. A mere ape in our world may be a scholar in its own, and the low life of any beast may be a source of deep satisfaction for the beast itself. Kanzi's glossary is full of words like *noodles* and *sugar* and *candy* and *night*, but scattered among them are also *good* and *happy* and *be* and *tomorrow*. If it's true that those words have meaning to him, then the life he lives—and by extension, those of other animals—may be rich and worthy ones indeed.

To Learn More

Animal Liberation by Peter Singer The book that launched the animal-rights movement nearly 40 years ago, its ideas remain fresh.

Bonobo Handshake by Vanessa Woods Insights from a researcher and journalist who lived with bonobos in a war-torn part of Africa.

Comparative Cognition edited by Edward Wasserman and Thomas Zentall Though a heavy lift for casual readers, it covers much of the animal world.

The power of the pack: life in animal society

If you're a spotted hyena, the last thing you want to do is get the boss mad. Most days, your hyena life isn't half bad. You live in a large clan of perhaps 90 members, you hunt together, eat together and bed down together, and depending on how many of you there are and how aggressive you care to be, you have a pretty fair patch of land to call your own. Even a small group of hyenas with modest ambitions living in the Serengeti plains can claim sovereignty over 15 square miles of territory. Bigger groups with bigger dreams can reign over 385 square miles. That's not just a homestead; that's a little state. Hyenas from different clans are permitted free passage across your borders if they're on their way somewhere, provided they keep moving, eat nothing and don't overstay their visas. Most visitors honor those rules.

What keeps the hyena nation running as smoothly as it does is hard work and discipline. Forget the stories of lazy, greedy hyenas lurking at the edges of a lion kill trying to steal a meal. It's more commonly the hyenas that will rely on a good honest hunt to keep themselves fed and the lions that will try to filch the carcass. But the interlopers usually have a fight on their hands. Hyenas trying to repel a lion will emit loud whoops to recruit as many members of their clan as they can and then whip one another into a fighting pitch



ONE OF THE GANG
Hyenas operate
as part of a clan,
defending the fruits
of their hunt and
upholding a strict
matrilineal culture.



with rumbling, lowing sounds. That “laughing” that has become such a part of the hyena reputation is indeed a form of nervous giggle, something they emit as they prepare to fight. But they get over their nerves fast.

To the extent that trouble arises in hyena clans, it’s less with outsiders than among the individuals themselves. The groups are matrilineal in the most absolute ways possible. The very highest-ranking male is subordinate to even the lowest-ranking female, and since the clans are made up of many matriline—*or families ruled by the mothers*—there are a lot of females the boys must obey.

Among the females themselves, there is a constant struggle for dominance that plays out

in the form of fighting, which can be both very frequent and very fierce. During just one season, a group of researchers studying a clan in Kenya observed the dominant female engaging in 117 fights with 19 lower-ranking females, and winning nearly all of them. In the same period, they observed a total of 633 fights among all of the females, as the ones that ranked below the alpha tried to claw their way, literally, to the top. The losers of those battles can be easy to identify by the ugly scars they carry for life.

But never mind the bloodshed, never mind the street justice; the hyena community is a complex and clever and even civilized thing. There is order there, there are customs there, there is safety and food and a profound sense of commu-

Hunting and foraging are other reasons to form communities. Lions are famous for the cunning way they collaborate during a hunt.

nity there. And hyenas are not unusual.

Humans rightly pride themselves on the great civilizations we have built, but animals—at least when you grade them on the curve that corrects for smaller brains, simpler language and the absence of opposable thumbs—are often our equals. Apes live in organized troops governed by customs and laws, fish swim in schools that are often choreographed in their movements, ants and termites and honeybees live in great busy cities. For every rogue or solitary species whose members prefer to hunt alone, live alone and die alone, there are many more prides of lions, pods of dolphins, smacks of jellyfish and exaltations of larks. The communities are as varied as their often poetic names, and the kin-



ships the animals build there can mean as much to them as ours do to us.

A More Perfect Union

Living as part of a group, for all its benefits, does not come without cost. You have to share your food, obey the rules, submit to your hierarchical superiors and fight to keep your inferiors in their place. If you can figure out a way to avoid all that work—to mate and eat and survive on your own—it would pay to do it. Living collectively, then, must serve other purposes.

The first and perhaps most important of those functions is avoiding predation. Getting through a day without getting eaten is always a numbers game, with any one individual's risk of winding up as a meal falling as the number

of surrounding individuals goes up. A single fish in a sea of sharks is almost certainly going down soon. But that same fish in a mammoth school has a much better chance of not being the unlucky one that winds up as a meal, giving it at least one more day to live and mate and pass on its genes—which is the biggest reason it's alive in the first place. Zebras and other herd animals organize themselves into similarly large risk pools, sometimes even forcing the aged and lame to the periphery of the group, exposing the least valuable individuals to the greatest risk, thus satisfying the predators' hunger at the lowest cost to the community as a whole.

"If there are a lot of predators in the area, you tend to group up," says John Marzluff, a professor of wildlife and habitat relationships

at the University of Washington. Staying out of the jaws of those predators is what Marzluff describes as an "ultimate driver" of social clustering. "[It's] basically the costs and benefits of doing something with respect to reproduction and surviving."

That's not to say the risk of predation always impels animals to come together. Depending on the species, it may actually argue for a solitary life. Octopuses, for example, have short life spans and do all their reproducing in one great, fertile go, making it smart to find a safe place to hide out and do your living, breeding and dying there. "As soft-bodied animals," says biologist Jennifer Mather of the University of Lethbridge in Alberta, "[octopuses] are most concerned about not getting eaten, so they don't spend a

Getting through a day without getting eaten is always a numbers game, with any one individual's risk of winding up as a meal falling as the number of surrounding individuals goes up.



ONLY THE LONELY The octopus, a soft-bodied species susceptible to cannibalism, lives its life primarily in solitude, venturing out of its den only to hunt or to meet another individual for mating.

lot of time out in the open where they could be snatched up."

Indeed, they don't even trust their own kind entirely, since some species of octopus can be cannibalistic. "Octopuses recognize their own skin by chemical cues," Mather says, "but do not seem to recognize the skin of other octopuses."

Hunting and foraging is another reason to form communities. Lions are famous for the cunning way they collaborate during a hunt, using a sort of pincer movement in which some members of the pride give chase to, say, a zebra herd, driving them into an ambush of other lions waiting in their path. Whales do something similar, creating bubble nets that confuse and effectively imprison prey. Dolphins herd fish like border collies herding sheep, forcing them into a narrower and narrower area until the fish are up to 200 times as densely grouped as they would ordinarily be. From there, the dolphins need do little more than open wide and plunge in.

Foragers, either hunter-gatherers like chimpanzees or gatherers like pinyon jays, use a different but equally collaborative strategy to keep themselves fed, staking out a central territory that they use as a sort of base camp and then ranging into the field each day to collect provisions. If everyone in the flock or troop went out

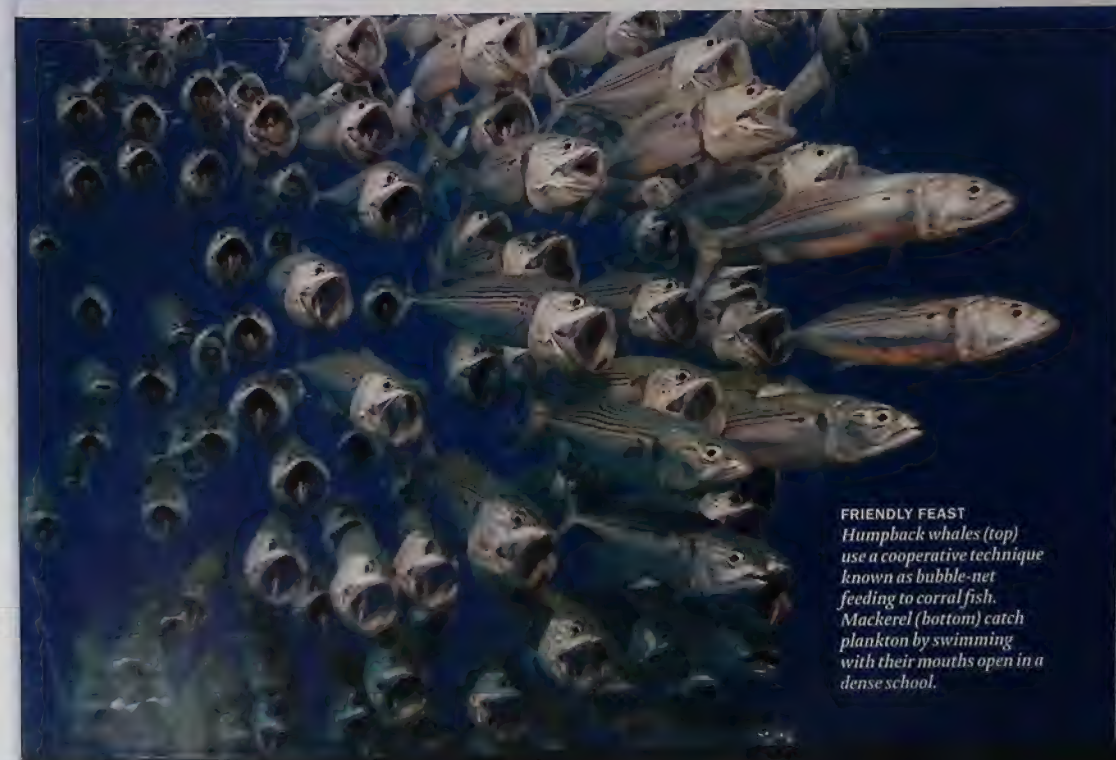
on these expeditions, it would be easy enough for all of them simply to eat their fill on the spot. But since there are almost always some individuals—typically mothers and young—left behind, the foragers have to be very organized about who gathers what and how much they bring back. And since they're probably not the only animals living in that resource-rich patch of wilderness, they always have to be wary of invaders and claim-jumpers.

"When resources get unpredictable, you [have] to be very mobile and move around and have a big group to find food, harvest it, bring it back and defend it efficiently," says Marzluff. The more individuals that pitch in to do that work, the more effectively it can be done. "Having numbers," he adds, "is helpful."

The Next Generation

As important as finding food—and not becoming food yourself—is, nothing shapes animal behavior quite as much as the business of mating and rearing young, and the social rules that get built around this primal task vary hugely from species to species. Prides of lions are under the sole reproductive control of a single dominant male who reserves to himself the right to mate with all of the females. That's hardly an egalitarian system, and it's certainly not much fun for the lower-ranking males, but it makes adaptive sense. Since that male must fight to attain his alpha position in the first place, as well as periodically defend it from aspirants to his crown, he will, almost by definition, be the strongest and fittest of the group, making it likelier that his offspring will inherit those qualities and strengthen the overall gene pool. And males will stop at nothing to be the one that rules that pool. When an outsider forces his way into the pride and topples the existing leader, one of his first acts in office will be to kill all the cubs, placing the females back in estrus, and then take care of providing them with replacement babies.

The lionesses may submit to this, typically becoming fertile again within eight months of the new male's ascent, but they don't go down without a fight. According to a joint study conducted by researchers at the University of Minnesota and the University of Sussex in England,



FRIENDLY FEAST Humpback whales (top) use a cooperative technique known as bubble-net feeding to corral fish. Mackerel (bottom) catch plankton by swimming with their mouths open in a dense school.

females will often work together to discourage the interloper before he can take over, often by engaging in what's called a roaring chorus, which is just as loud and scary as that term suggests.

Both male and female lions roar to advertise their ownership of territory, though not every member of a pride will bother if other individuals are handling the job. Females with cubs, however, almost always join in, the researchers found, and since those mothers preferentially associate with other females that also have young to protect, that one group of highly motivated mamas can produce a terrific—and terrifically intimidating—racket.

Hyenas, with their complex matrilineal rules, do things very differently. All of the females will have the opportunity to breed, but all of the young that result will not come into the world as equals. Any one hyena cub will inherit its mother's high or low rank and, like the mothers, will have to fight later in life for the chance to move up. For males, being born to high rank represents the only chance they have to gain a position of relative power in the hyena world. But it's a position they willingly surrender when they reach mating age, leaving their clan and joining another one, thus spreading the group's genes but assuming the role of just another low-ranking male in the clan they enter.

Crows, whose growing reputation for intelligence is one of the most surprising areas of modern animal research, manage the job of raising young in a more appealing way, at least by our standards. Mating for life—unless the pair cannot breed successfully together or one member becomes incapacitated or dies—crows form a nuclear family, with the pair raising their chicks attentively and alone. That changes, however, if they live in a comparatively large, hard-to-defend territory. In that case, the parents' older offspring from earlier seasons may stick around to help look after their little brothers and sisters as well as defend the nest and neighborhood.

"It's very much like kids who come back after college because they can't get a job," says Marzluff. "It's cheaper for them to stay at home, share resources and contribute to them as well." As with college grads camping in the basement, too, this isn't an arrangement that can go on in-

definitely. "Eventually they go out and find their place in the world," says Marzluff. "In the crow world, that's a chunk of land that they have to be powerful enough to defend against others."

This business of alloparenting, or relatives helping to raise a breeding pair's young, is one of the most powerful glues that bond animal communities. Dolphins can be alloparents, with grandmothers often helping to care for their daughters' babies. Orcas are thought of as perhaps the most dedicated alloparents of all, with births attended by multiple members of the extended family and all of them devoting nearly as much care to the new baby as they would to their own.

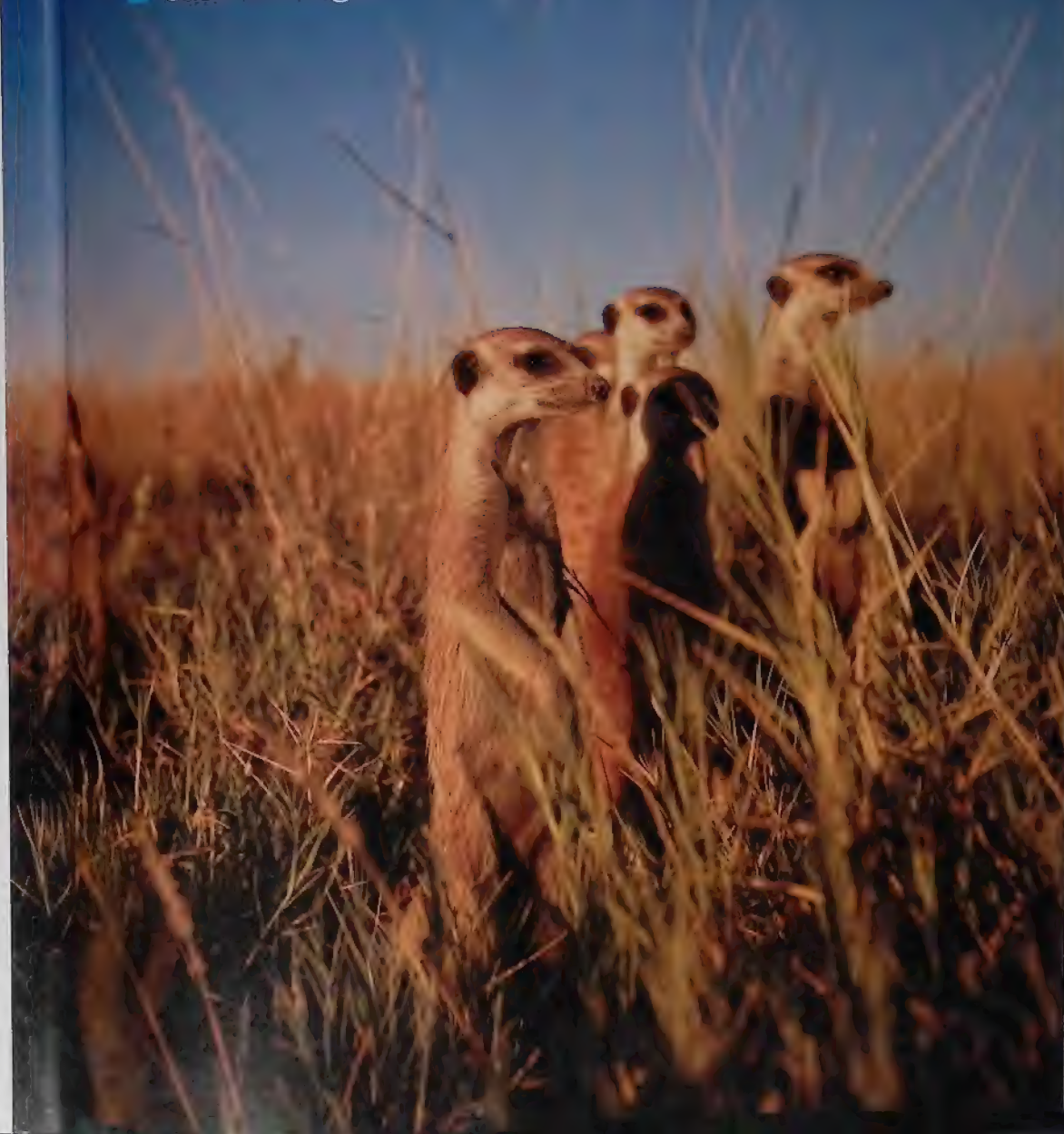
"The family structure of the orcas is not only an extreme example of close-knit and very sophisticated family bonding," says behavioral biologist Toni Frohoff, author of the book *Dolphin Mysteries*, "but they also exhibit some of the most peaceful familial interactions." So central are family lines in the orca community that when a dominant breeding female—who may live to be 100 years old and serves as the group's repository of collective knowledge—dies, the pod may break up altogether.

Simple Critters, Complex Worlds

No matter how sophisticated the prides and pods of large, comparatively intelligent animals become, there is nothing that quite defines animal communities like the social systems insects build, particularly bees and ants. Beehives may have up to 80,000 residents during the summer (only a little smaller than the population of Trenton, N.J.), with labor divided among the food-hunting workers, the breeding drones and the queen. It's a big and busy society that works exceedingly efficiently—but it's nothing compared with the megalopolises ants build.

One of the largest ant colonies ever discovered was on Hokkaido, the northernmost of the main islands of Japan. Covering 670 acres, it's home to one million queens and 306 million worker ants, or about the same as the population of the U.S. The very largest colony ever found stretches across of 3,700 miles of coast in southern Europe and contains uncounted billions of ants. Technically, these aren't single colonies

Meerkats forage in groups while sentries keep watch and sound an alarm call in case of danger.



FLOCKING TOGETHER

Several bird species, like the puffin (top), swan and emperor penguin, practice serial or even lifelong monogamy. Monogamy is rare in mammals, though some, like horses, do maintain long-term bonds.



ANIMAL ALTRUISM Eusociality—defined by overlapping generations, cooperative parenting and reproductive division of labor—is found mainly in insects, whose behavior ensures colony survival often at a cost to individuals.

but a series of them that have overlapped, the equivalent of greater metro areas like Baltimore and Washington and northern Virginia that effectively merge as they outgrow their borders.

Despite the complexity of such ant populations, there is some question among animal researchers about whether they might be less a collection of discrete individuals than something analogous to individual cells making up a single, larger organism. Mark Moffett, a research associate at the Smithsonian Institution and author of the book *Adventures Among Ants*, analogizes the nonreproducing worker ants to the cells of the heart or the lungs, which sustain the body but have no life apart from it. The queen, in contrast, designed to do nothing but reproduce, does the job of the ovaries or the testes, producing what's necessary for the next colony—the next body—to go on. Moffett even cites studies showing that while individual ants don't have very impressive learning skills, an entire colony, with sufficient practice, can be trained to improve its performance on certain tasks like migrating from one nest to another with greater speed and efficiency the more times it practices.

"A colony is an organism divided," Moffett

writes. "Its body spreads over space in pieces that give it a multitude of eyes and brains with which to glean nutrients, energy and information." Assembled into a single organism, the ants in a colony even achieve a size that feels about right, weighing in at 88 pounds, as Moffett estimates it, about the same as an 11-year-old boy.

Such an analogy, of course, can go only so far. No single mass of ants is ever going to be capable of thinking and laughing and creating and just plain experiencing life the way an 11-year-old human can. And no collection of 306 million ant individuals will ever build a culture remotely as rich as the one 306 million people can.

But societies at both ends of life's complexity spectrum still have more in common than not: the willingness to cooperate, to sacrifice, to subsume the individual into the whole in order to achieve a larger good. That's not easy and it doesn't always work out, which is why bee colonies collapse and orca pods fall apart and great cities like New Orleans and Detroit sometimes come to ruin. Solitary animals—like off-the-grid humans—will always lead simpler lives. But the potential rewards of life in a community mean they'll always lead poorer ones too.



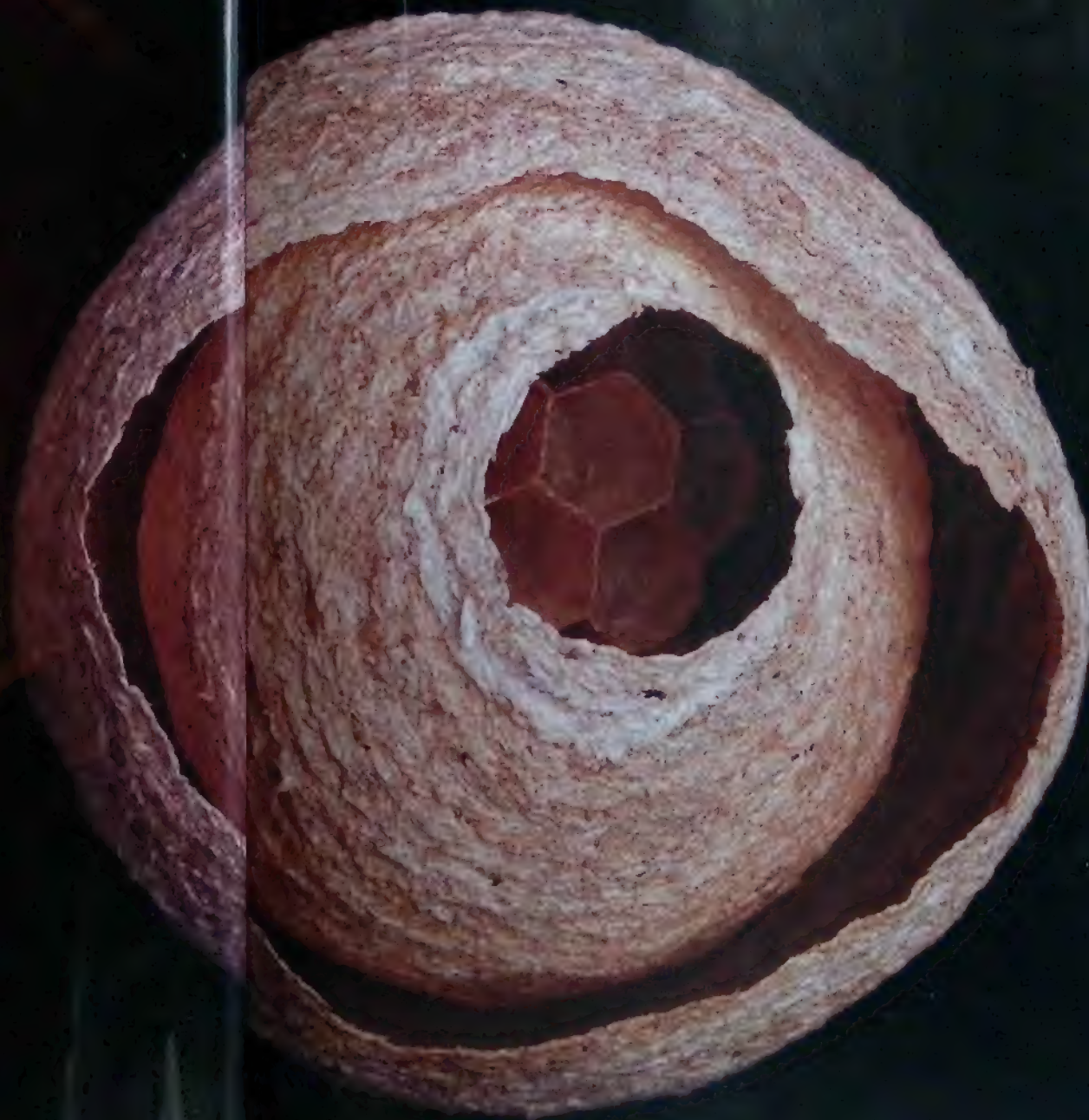
Master builders of the animal kingdom

PHOTOGRAPHS BY INGO ARNDT

When we picture ingenuity, we tend to think of our human selves. Because life in the wild is so ruthless, however, nature is perhaps the most appropriate place to find examples of engineering one's surroundings to advantage. Much of 17th-century philosopher Thomas Hobbes's famous description of mankind's natural condition outside society—"solitary, poor, nasty, brutish and short"—could easily be applied to the lives of many creatures of the animal realm. Millions of years in these unforgiving conditions have led animals to evolve into impressive architects whose hallmarks range from permanence to portability, camouflage to showiness, reproductive allure to domestic paradise. German nature photographer Ingo Arndt spent two years shooting the constructions of nonhuman builders all over the world. What he captured are some of the most remarkable displays of form following function, as animals cleverly manipulate their landscapes for a single purpose: survival.

ESPRIT DE CORPS

Wasps, unlike honeybees—which construct combs using their own waxy secretions—employ their strong mandibles to masticate wood to a pulp that they use for building. Their success as a colony depends on the cooperation of thousands to grow a nest, tier upon tier, as their queen lays her eggs.





PRACTICE MAKES PERFECT

Sparrow-size baya weavers in Namibia build large nests using thin blades of grass that dry and harden in the sun after being skillfully woven into place. Young birds diligently rehearse the craft of erecting these elaborate, waterproof structures, which sometimes grow heavy enough to pull trees down.



AQUATIC ARMOR

Caddis-fly larvae carefully select shells, plant seeds and pebbles that are fused with excreted silk threads to form a portable casing. The insects are eaten by trout in both larva and adult stages, so the vessels they build are designed to protect the larvae's soft abdomens in their underwater habitat.



A FAMILY AFFAIR

The nests of Australian weaver ants hang in groups from high tropical tree branches. The leafy cases require cooperation among generations, as adults build them over a roughly 24-hour period using foliage woven together with silk produced by their larvae.

**SAFE HAVEN**

Most mammals, having the benefits of fur and embryonic development in the womb, don't characteristically build what are considered nests. Harvest mice, one of the exceptions, use their nimble hands and sharp teeth to split three-foot-high grass into threads, which they weave into balls that are held aloft by surrounding stalks of grass.

**TRASH TO TREASURE**

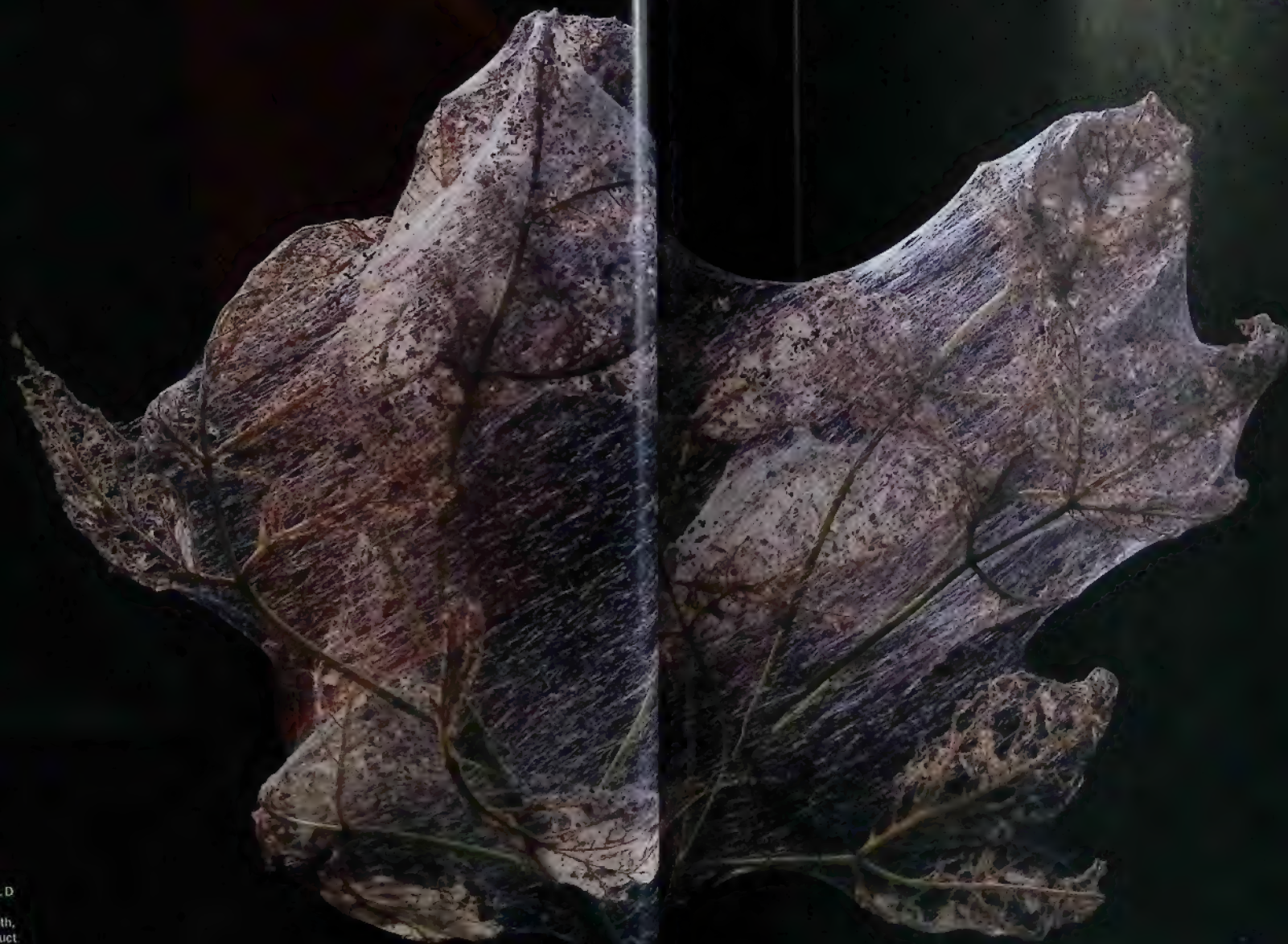
Birds use grass, twigs, feathers and even garbage as building materials. Here, collared doves, native to Europe and Asia and introduced in North America in the 1970s, erected a roost by weaving together branches and electrical scraps. The species, which has easily adapted to suburban habitats, is known to roost on utility poles.

**SEASHELL COLLECTION**

Carrier snails cement pebbles and shells of other mollusks to their own. The reasons for the practice are still not completely understood, but scientists believe it may serve to increase overall size or act as camouflage.

SILK STRONGHOLD

Working as a team, the larvae of the buff-tip moth, native to Europe, construct protective webs around sections of plants to shield them from predators as they eat. They move on to another branch after their feast on each set of encased leaves is complete.



Those who know the meaning of friendship

BY CARL ZIMMER

Since 1995, John Mitani, a primatologist at the University of Michigan, has been going to Uganda to study 160 chimpanzees that live in the forests of Kibale National Park. Nineteen years is a long time to spend watching wild animals, and after a while it's rare to see truly new behavior. That's why Mitani loves to tell the tale of a pair of older males in the Kibale group that the researchers named Hare and Ellington.

Hare and Ellington weren't related, yet when they went on hunting trips with other males, they shared prey with each other rather than competing for it. If Ellington reached out a hand, Hare gave him a piece of meat. If one of them got into a fight, the other backed him up. They spent entire days traveling through the forest together. Sometimes they were side by side. Other times they were 100 yards apart, staying in touch through the foliage with loud, hooting calls. "They'd always be yakking at each other," says Mitani.

Their friendship—for that's what Mitani calls it—lasted until Ellington's death in 2002. What happened next was striking and sad. For all the years Mitani had followed him, Hare had been a sociable, high-ranking ape. But when Ellington died, Hare went through a sudden change. "He dropped out," says Mitani. "He just didn't want to be with anybody for several weeks.



IMPROVING ODDS
As in human bonds, animal friendship can lead to romance. Animals with pals often reap reproductive benefits.

He seemed to go into mourning.”

For evolutionary biologists and anthropologists, friendship has been considered one of the core traits of only one species of ape: us. The conventional thinking held that, along with our capacity to feel love, loyalty and compassion, our ability to forge long-term, meaningful bonds with friends set us apart. To the degree that nonhuman animals have exhibited such traits, they’re really just making a genetic calculation. They’ll protect family members, but only because they share so many genes. They’ll help an unrelated member of their species too, but that’s an even colder transaction known as reciprocal altruism: I’ll do you a favor today, but I expect one in return tomorrow.

Humans also do this kind of interpersonal ledger balancing. It’s not for nothing that if a friend lends you \$10, you feel a faint sense of unease until you pay it back. If we didn’t all feel that, *Homo sapiens* would not have become as cooperative a species as it is. But reciprocal altruism is to friendship as reproduction is to romance. In both cases, we start with a primal impulse and then embroider deep feeling into it. Animals, we’ve always told ourselves, do nothing of the kind.

Mitani and his colleagues now know better. Unrelated chimpanzees, for example, can develop strong bonds that last for years, and long-term studies by other researchers have revealed durable friendships beyond the chimp species. Dolphins make friends with unrelated dolphins, hyenas make friends with hyenas, and the same is true for elephants, baboons and horses. No one can say how many more species—mammals and others—will be added to the list.

True animal friendship is not about the neighborhood dogs’ playing and wrestling when their owners take them to the park any more than true human friendship is about the pickup soccer game a group of kids play in an adjacent field. There’s an improvised, on-the-fly quality to those interactions, and though they’re sociable enough, they’re limited to the moment. Animal friendship is about enduring bonds defined by

TIME contributor Carl Zimmer, a lecturer at Yale University, has published 13 books about science and writes about animals for various publications.

sharing, sacrificing and, when circumstances warrant it, grieving. Not all animal friends exhibit all those behaviors, but they exhibit enough of them, with enough consistency, that something deep is clearly going on.

However widespread animal friendship is, it is changing our assumptions about how nonhuman societies work. It could also change the way we think about our friendships, and even about our health. It’s well established that having close friends can contribute to a longer life and a lower incidence of disease, but it’s never been easy to establish why. Studies of animals might provide some answers. Even before that work is done, though, one thing is clear: humans have always known that it’s hard to get through life without friends, and it appears that animals are wise to that secret too.

Stalking the Wild Friend

In the field of animal-friendship research, charismatic critters like dolphins and chimpanzees get a lot of the attention, but it’s baboons—far more distantly related to us than the great apes—that have provided some of the most powerful insights. In the late 1990s, UCLA anthropologist Joan Silk was working with Princeton primatologist Jean Altmann on a long-term study of savanna baboons in Kenya’s Amboseli National Park. At first, Silk and her colleagues focused on individual baboons, noting such things as their hierarchy in the troop and how often they were groomed by other monkeys. But then Silk wondered about the relationships among the individuals. Were they all the same, or did each baboon have different relationships with different individuals?

Silk came up with a painstaking method for measuring the strength of the relationships between primates. She and her colleagues went back through their records and randomly selected hundreds of observations of each female baboon from years of fieldwork. Then they determined how often that baboon was sociable—sitting near another individual or grooming it, say—and noted which baboon was pairing off with which. When the scientists crunched the data, they discovered a complex social world they hadn’t noticed before. “They have very strong relationships with some females and weak relationships with others,”



says Silk. In many cases, the strongest bonds were between unrelated females, and those lasted years. To describe these relationships, Silk, who arrived at the work as a skeptic of the whole idea of animal friendship, at last began to use what she calls the F word.

Other scientists conducting long-term studies of species noticed something similar going on. In 1970, Randall Wells, a biologist with the Chicago Zoological Society, began following bottlenose dolphins in Sarasota Bay in Florida, getting to know them so well that eventually he could distinguish one from another simply by the appearance of its dorsal fin. Over time, he discovered that some unrelated male dolphins spend considerable amounts of time together in pairs. “Usually they’re swimming side by side,” says Wells. “The rest of the time we’ll see [them]

In the field of animal-friendship research, charismatic critters like dolphins and chimpanzees get a lot of the attention, but it’s baboons—far more distantly related to us than the great apes—that have provided some of the most powerful insights.

alone, but they'll be back together again within a few hours."

Across a span of 40 years, Wells has been able to piece together the long-term history of these friendships. Male dolphins form their first friendships when they're young, and a pair will stay on good terms for years. If a male's friend dies, he will swim alone for a few months, but eventually he'll befriend another male.

Unrelated females do things differently. They spend time together during their fertile years, but these bonds are fluid, with individuals moving from one group to another in the bay. Only when they're in their 50s and no longer reproducing do female dolphins develop enduring bonds, and those are with just one or two other female friends.

One day in 2008, for example, Wells and his colleagues noticed that a 58-year-old female he named Nicklo had swum into the sea-grass meadows next to the lab. Dolphins sometimes go there to hunt the schools of mullet that frequent the shallow waters. As the mullet try to escape, the dolphin whacks them with its powerful tail, delivering a blow hard enough to launch fish into the air. A good fish-whacking leaves a mullet stunned so the dolphin can make an easy meal of it.

But that day Nicklo was not whacking fish on her own. She was on the hunt with an unrelated old female named Black Tip Double Dip. The pair of dolphins drove the mullet schools from different sides, each whacking fish into the air.

Wells had rarely seen two female dolphins fish-whacking together, but he began to see Nicklo and Black Tip Double Dip doing it more and more often. Sometimes they were joined by another old female named Squiggy. So much teamwork, of course, could simply be the utilitarian business of cooperative hunting: if three dolphins work together, all three eat better. But Wells and his colleagues would find the trio not just fish-whacking but also simply swimming in tight formation, apparently keeping one another company. It's not quite the Golden Girls, but it's not all that different either.

As evidence for the F word piled up, the question shifted from "Do animals make friends?" to "Why do they bother?" The most obvious answer is that friendships boost reproductive odds. If having friends somehow leads to having more ba-

bies, the friendliness trait gets passed on, becoming more common across the species. For male dolphins, the reproductive benefit may come from a friend's playing wingman. A single male may have a hard time driving off other males while mating, but two males working together may be able to do the job. Females lean on one another more after their babies are born. A group of dolphin moms will often form circles around their calves, perhaps protecting them from predators. "We call them playpens," Wells says.

Silk looked for a similar reproductive benefit among the Amboseli baboons. She ran a new analysis, comparing the number of offspring a

female had with her number of friendships. Here too there was a statistical baby bump. While female baboons with strong friendships were not necessarily likely to produce more young, the offspring they had were likelier to stay alive than the babies of females with shallower friendships.

The mechanism behind this wasn't clear, so Silk decided to team up with Robert Seyfarth, a primatologist at the University of Pennsylvania, and his wife, Dorothy Cheney, who have studied friendships among chacma baboons in Botswana. For this study, the scientists looked at the longevity of the friendly adults. On average, they found, the survival rate to age 15 for female

baboons with strong friendships is four times as high as that of those with weak ones. Long-lived mothers should increase the odds, at least in theory, for long-lived babies.

Silk's research has spurred other scientists to see what effects friendships have in other species. In New Zealand, Elissa Cameron of the University of Tasmania studies a population of 400 feral horses in the Kaimanawa Mountains. The horses live in bands that are typically not made up of close relatives. Sometimes the horses are aggressive. One might bite another or chase it away. But they can also be sociable. They run around together playfully. They use their teeth not to



THE PLEASURE OF COMPANY
Male dolphins form friendships very early in life, sometimes going solo for a period if a companion dies. Females wait to form lasting bonds until later in life, when they are beyond their mating years.



ODD COUPLE
Cross-species relationships, like that of Mzee the tortoise and Owen the hippo in Kenya, are likely the result of an unmet need for contact.

bite but to groom each other's manes. "Sometimes they stand with their heads resting on each other," says Cameron.

After collecting four years of data, she went through her records. She found that pairs of mares would establish strong bonds, and those bonds endured throughout her study. Cameron then did what Silk had done: she compared the strength of a mare's friendships with her reproductive success. And similar to Silk, she discovered that the more close friends a mare had, the more foals she could rear.

Never Mind the Genes

The principal explanation biologists always had for social behavior between unrelated animals is the favor-for-favor arrangement of reciprocal altruism. This would be particularly true among males, which don't have such a heavy investment in raising long-lived babies and thus would expect more immediate payback. There's little question that this plays a powerful role. But Seyfarth doesn't think animal friendship can be reduced to just a marketplace of immediate favors.

"In chimps, if you study them over a short

period, you'd see a bit of meat sharing, a bit of cooperation on forming alliances," he says. But if you look at chimpanzee pairs that have established friendships, these favors are separated by long periods of time. "There are often many days or weeks that pass in between successive acts, so they can't be done for immediate benefit. Over six months, it's much more balanced, and over two years, it's more balanced still. Animals are happy to tolerate a temporary imbalance because what matters is the long-term relationship."

One of the most provocative implications

of these studies is that friendships that evolved within species may sometimes reach across the species barrier. In her best-selling book *Unlikely Friendships*, journalist Jennifer Holland describes many such surprising pairs—a gorilla and a kitten, a cheetah and a dog, a hamster and a snake. YouTube, a decidedly more ad hoc source, is filled with clips of cross-species buddies.

But what you see onscreen may be less authentic than it seems. Barbara King, an anthropologist at the College of William and Mary and the author of *Being with Animals*, thinks a lot of these cases reflect wishful thinking more than actual friendships. "Right now the label is being applied far too broadly and uncritically," she says.

For King, it's not enough that two animals spend time near each other or greet each other enthusiastically. She would use the term friendship only if the animals put some effort into their relationship—by grooming, for example. Few of the relationships that you can find online meet King's standard, even those in which a predator gets cozy with an animal that might ordinarily be prey. Predators aren't on the prowl all the time, King points out, and they use a lot of cues such as the size and fitness of potential prey to determine if it's worth trying to go for a kill. (This might help explain the popular online clip of a cat that seems to befriend a crow, a very large and very smart bird that would not succumb easily.)

Still, even King admits to being taken by the story of Mzee the tortoise and Owen the hippo. Owen was found as a 1-year-old alone and dehydrated near the coast in Kenya in 2004. He was put in an enclosure at a wildlife sanctuary with the 130-year-old Mzee. To the surprise of the park managers, the two animals became inseparable. They slept and ate together, and Mzee would sometimes lick Owen's face. King is especially impressed by how the two animals communicate. "Mzee nips Owen's tail to nudge Owen along on a walk. Owen nudges Mzee's feet when he wants to do the same," she says. "Owen's nudging is quite specific: he nudges Mzee's back right foot when he wants Mzee to steer right and the opposite for going left." But scientists can't draw any deep lessons from a single pair of animals. King speculates that the young Owen simply sought protection and comfort from Mzee. "The need



NOT QUITE MAN'S BEST FRIEND
Dogs probably view fellow canines more as playmates and humans more as caretakers.

for close contact can be very powerful," she says. "If that need isn't being met by one's own kind, more normal responses may be swamped."

Another question that studies of animal friendship inevitably raise is how all this applies to our favorite nonhuman species, dogs. Despite what we might suspect, the science so far does not rank canines very high on the friendship scale.

"Pet dogs do form friendship-type relationships with other dogs in the same household," says James Serpell, director of the Center for the Interaction of Animals and Society at the University of Pennsylvania. "Dogs that socialize regularly in dog parks also seem to prefer to hang out with particular preferred canine companions."

Appealing as such scenes of amiable play are, however, most scientists think they fall well short of true friendship. Echoing King, they note the lack of evidence in dogs of the constancy, reciprocity and mutual defense observed in species such as chimpanzees and dolphins. They also point out that dogs evolved from wolves or wolflike mammals, and scientists don't see friendships in wolf packs. Thanks to domestication, dogs have become capable of being sweet and loyal to humans, but it's likely that they treat us more as guardians than friends. Dogs are neither our best friends

nor one another's, which is not to say they're not warm and wonderful company all the same.

Healthy Friendships

Studies of animal friendships may deepen our understanding of how complex the nonhuman world is, but there are more tangible benefits as well. The better we understand how friendships change an animal's physiology—improving its health in the process—the more we can learn about the power of those processes in ourselves.

Lauren Brent, a postdoctoral researcher at Duke University, is one of the leaders in this field. Brent conducts her work on a small island off the coast of Puerto Rico called Cayo Santiago that is home to about 1,000 rhesus monkeys. Brent spent four years on Cayo Santiago carefully observing one 90-monkey group. Once she identified probable friend pairs, she wanted to determine if their relationships influenced their hormone levels, specifically glucocorticoids, which are produced in response to stress. Drawing the monkeys' blood would have been a stressful experience in itself, skewing the results. Fortunately, it's now possible to measure levels of hormones and other molecules from urine and feces. "You just follow your monkeys

around and wait for a sample to be deposited," Brent says. The only trouble came when the monkeys figured out what she was up to. They sometimes fought her for their feces. "Some of them just get possessive," says Brent. "I have no idea why."

It was worth the battle. Brent found that the amount of glucocorticoids in the rhesus monkeys varied with the strength of their social networks. When monkeys had strong friendships with a few other monkeys, their glucocorticoid levels were low. Less sociable types had higher readings. Seyfarth and his colleagues found similar results in baboons. When members of that species lose close family members, their glucocorticoids soar. They respond by making new friendships with other baboons, offering to groom them and perform other favors. Soon their hormone levels fall to normal. Research on nonprimates also lines up with these findings. In studies of domesticated horses outfitted with sensors, researchers discovered that when friends groom each other, their heart rate slows. Wells plans to study hormones in dolphins by taking tiny skin samples from them.

All these findings, of course, closely track what we know about friendship benefits in



WHAT FRIENDS ARE FOR
Research has shown that monkeys with friends enjoy lower levels of stress hormones, which, as in humans, may help extend life.

humans. Studies have shown that people with close social networks have lower blood pressure, lower levels of stress hormones and more robust immune systems than those without. In 2010, scientists at Brigham Young University analyzed data gathered from more than 300,000 people. They found that having poor social connections can raise the risk of premature death as high as that from a smoking habit and even higher than that from obesity.

If humans came late to the idea that other animals have the same capacity to form friendships that we do and derive the same benefits, it may be that we weren't paying attention. Chimpanzees and baboons, which both form long-lasting friendships, share an ancestor with humans, one that lived 30 million years ago. Maybe that monkey-like progenitor formed friendships with its troopmates, and maybe it inherited the ability from a still more distant mammalian grandparent. Even as we all diverged into multiple species, pursuing our very different evolutionary arcs, all of us—Nicko the dolphin and Hare the chimpanzee and Bob, the guy who's been your best friend since high school—may have retained the simple but powerful ability to find and care about one another.

**Animals
aren't
supposed
to feel grief.
But if this
isn't mourning,
what is it?**



SADNESS IN THE STABLES
*Horses can lapse into
apparent depression when
they lose companions.*

Animals are not insensate—less sensate than us, certainly, but able to bond and romp and care and suffer in their own particular ways.



THE COST OF CARING

A gorilla at a German zoo mourns her baby. Like humans, apes may grasp the finality of death.

4 MOURNING

Nobody feels cuddly about crows. They're too big, too loud, too bold, too mean. They scavenge with the greed of buzzards, prey without the grace of eagles and even chase down children who come too close to their nests. They are the dark symbols of human mythology—portents of plague, of sorcery, of evil. There's a reason the proper term for a flock of crows is a "murder," and it's not because we like having them around.

But there's something deeper going on in the soul of a crow. An animal that inflicts death so readily seems deeply moved when one of its own kind dies. A dead crow lying in the open will quickly attract two or three other crows. They dive and swoop and scold, emitting a very particular call that summons up to a hundred other members of the flock. With near ceremonial coordination, they land and surround the body, often in complete silence. Some may bring sticks or bits of grass and lay them next to—or even on top of—the remains. Then, tribute paid, they turn and fly off.

"They seem," says University of Washington wildlife scientist John Marzluff, "to be mourning a loss."

That, it hardly needs saying, is not what we expect. Human beings have fixed ideas about the hearts and minds of beasts, most of them not very flattering. Animals are simpletons on the whole, sometimes capable of impressive flashes of cleverness and a kind of wagging, nuzzling, tongue-lolling love. But abstraction? No.



FAMILY TIES Eleanor, the matriarch of an elephant herd in the Samburu National Reserve in Kenya, falls ill a few months after giving birth in 2003. Another female, Grace, showing physical signs of concern and stress over her relative's condition, attempts to assist her.

Empathy? No. Even a rudimentary sense of the arc of life and their own mortality and the great wrenching loss that is death? Please.

Yet the fieldwork says otherwise. There are accounts of chimp mothers that refuse to surrender a baby that has died, holding the body for days or weeks after it has gone cold and begun to decompose. There are elephants that stay by the body of a fallen herdmate long after a death—examining, touching, attending—or stop to caress and examine elephant bones they find. There are dogs and cats that languish and refuse food when a playmate dies, the cats expressing their grief with a terrible keening cry. Bonobos rage, rage against the dying of the light, sometimes throwing rocks at a dead troopmate and pounding its chest in frustration before pounding their own. Apparent sorrow following a death has

been observed on the farm—among goats, pigs, ducks—and in the oceans as dolphin mothers, like primate mothers, push the bodies of their dead young in front of them.

It's impossible to look at this behavior and not see something that's an awful lot like mourning, but science, in its own way, rages against all of it. For every seeming grief ritual, it's possible to posit a cold, adaptive purpose: sorrow may simply be fear of the predator that killed a friend; rage may be an attempt to repel the same killer. And without the aid of self-reporting, which is a pillar of human psychological research, it's anthropomorphic in the extreme to presume to know what's going on in the heads of animals. Science's complaints are legitimate—and they miss something too.



A FRIEND IN NEED Grace, right, pushes Eleanor up, but the elephant's hind legs soon begin to collapse again.



REQUIEM After Eleanor's death, another family arrives. One individual, Maui, rocks over the body for several minutes.



LOSING HOPE The family keeps moving. Grace remains with Eleanor for another hour but eventually leaves.



BROKEN HEART Eleanor's young orphan visits the body, whose tusks have been removed to deter poachers.

Animals are social creatures just like we are. They form relationships that for them can appear to be every bit as important as ours are to us, which means that at some point they must experience the end of them. "They're bonded like us," says Barbara King, a professor of anthropology at the College of William and Mary and author of the book *How Animals Grieve*. "We're all socially attuned, and in many ways our brains are even wired similarly. Why wouldn't animals mourn?"

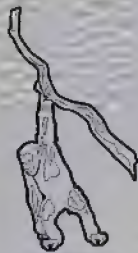
If they indeed do so, the mechanisms at work may be the evolutionary precursors of our own grief process. "It's easy to see why these rituals would have evolved," says Marc Bekoff, a professor emeritus of evolutionary biology at the University of Colorado, Boulder. "It's a wake. They're reinforcing the feeling that things will

be O.K., just like grieving human families tell themselves the same thing."

Bekoff and King are among the leaders of a growing group of researchers exploring the question of whether animals mourn. It's not one that can be answered empirically yet—no conclusive lab tests or brain scans exist, though some preliminary ones do. It's dependent instead on the growing body of observations pouring in from researchers in the field, from wildlife managers at zoos and even from pet owners, all struck by the pained and poignant behavior of the animals around them. The beasts, it seems, are suffering—and in ways we recognize well.

The Methods of Mourning

Grief, like animals, comes in multiple species, and as with so many things, it's the human vari-



Bereavement and the Beasts

Bonobo mothers carry babies long after they've died and treat the bodies with care. Adults will fight to protect the body of a dead troopmate.



Elephants may attend the body of a dead herd-mate for a week after death. They reverently examine elephant bones they find in their travels.



Crows and other corvids mob a dead flockmate, studying it closely. They may cover it with grass or bring twigs in seeming tribute.



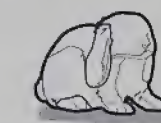
Baboons, like bonobos, carry dead babies for many days. Stress hormone levels in their blood rise after a relative or close social companion dies.



Dogs become deeply attached to humans. One Akita in Japan went to a train station looking for its deceased owner every day for a decade.



Cats visit and revisit a house where a deceased companion used to be found. Their grieving may be accompanied by a keening cry.



Even **rabbits** may feel. In one reported case, a survivor spent weeks making "tragic sweeps of the house," its owner said, seeming to look for a departed friend.

ety that's the most complex. For us, the loss of a loved one inflicts a pain like no other. "Gut me," King quotes journalist Roger Rosenblatt writing in a book about the death of his adult daughter. "Slice me down the earth's meridian from north to south. Lay my bones outside my skin." It's a terrifying description as much because of its visual awfulness as because of the fact that it captures the experience. The rituals we build around that torment—the gathering in rooms, the bowing of heads, the paradoxical laughter at the wake, often with the deceased as the foil—medicate the pain and ease the passage.

No one pretends that grief in animals is anywhere near as complex. For starters, they don't have the brainpower for the long reflection and obsessive remembering that makes grieving such a slow process for us. More important, they couldn't afford to indulge it even if they did.

"Most animals are preoccupied with surviving," says Marzluff, who is also the co-author of *Gifts of the Crow*. "Mother Nature is harsh, and if there's value in dealing with a death, there's also value in moving beyond it quickly. Otherwise you're going to get weeded out."

Instead, what researchers point to in identifying animal grief is a suite of observable behaviors familiar to anyone experiencing loss or depression: listlessness, lack of appetite, weight loss. "I'm looking for something prolonged, something visible," says King. "I don't think it's productive to ask if animals really understand death, since there's no way we can know that. I'm just interested in what we can see."

There's no shortage of behaviors that fit that description. By most measures, the animals that seem to experience death in the most humanlike way are not the ones that are genetically closest to us—the great apes—but elephants. The literature has long been rife with reports of the funeral rites and almost reverential treatment of remains that occur among elephant herds. British zoologist Iain Douglas-Hamilton was particularly struck by the 2003 death of an African elephant known as Eleanor at a national park in Kenya.

Eleanor was the matriarch of her herd and had given birth less than six months earlier. Suf-



SAYING GOODBYE Chimpanzees, seemingly stunned by emotion, watch as caretakers prepare to bury the body of their beloved comrade Dorothy, who died of congestive heart failure, at a rescue center in Cameroon.

fering from an illness, she collapsed in the presence of another female. That elephant, known as Grace, trumpeted, nudged Eleanor and tried to push her up with her tusks. As Eleanor died the next morning, another female, Maui, approached and stood over her, rocking and examining her. For a full week, Eleanor's baby and the females of the herd visited the remains. They kept coming after park workers had removed Eleanor's tusks to deny poachers their prize. They came even after scavengers had begun to eat the remains. The baby nuzzled her mother's body and tried to nurse from the other young calves. But the milk never came, her mother never moved, and the baby soon died too.

"I see so clearly the emotional ripple effects of Eleanor's death," says King. "I wouldn't want to say every single elephant who approaches Eleanor is grieving. Some may simply be curious. But the extreme distress Douglas-Hamilton describes telegraphs to us across species lines."

The great apes approach things differently. One reason may be that their superior brain-

power allows them to grasp the permanence and inevitability of death in a way other animals don't. Primatologist Frans de Waal, the director of Emory University's Living Links Center, points to a scene he observed when a troop of bonobos encountered a poisonous snake known as a Gaboon viper. The bonobos approached the viper only closely enough to poke it with a stick until a female seized it and flung it onto the ground, killing it. In a blink, the feared animal became a benign object, with young bonobos even examining its fangs and wearing it like a reptilian lei. "None of them expected it to come back to life," de Waal says. "Dead is dead."

That awareness, which hits grieving humans in terrible waves of existential permanence over the course of months, makes things harder for apes too. At the Burgers' Zoo in Arnhem, the Netherlands, an adolescent female chimpanzee named Oortje contracted an infection that was not responding to medication. One afternoon when the animals were in their indoor enclosure, Oortje seemed particu-



DAILY DEVOTION A bronze statue in Tokyo honors Hachiko, a dog who met his owner after work every day near Shibuya Station. After the man's death in 1925, the Akita continued the ritual for a decade.

larly sickly, and another female approached her and stared into her eyes, then broke out into screams and began pounding herself on the chest. Oortje tried to vocalize back but toppled over and died. A scream erupted from another chimp, and then all the animals in the large enclosure grew completely still.

It defies science to say with certainty that the chimp closest to Oortje knew that death was coming, but it defies intuitive observation to say otherwise. "The death of Oortje and of the snake suggest that the death of others is on the minds of primates and affects them deeply," says de Waal. "Evidence suggests that they know that once an individual has become immobile for a length of time, hope for revival is dim indeed."

Just Say No

Dim hope is not the same as no hope, and humans exhibit a desperate denial of death all the time. Family members in emergency rooms implore doctors to keep heart-shocking and chest-pounding accident victims long after life

functions have quit. Psychics and Ouija-board makers owe their living to our stubborn refusal to accept the dead-is-dead dictum. Religion, too, is a reflection of that. There's much more to the study of divinity and the deep faith of believers than just a desire for eternal life, but that's still part of religion's appeal.

Among animals, this behavior seems best expressed in the strange practice of corpse carrying. Chimps, bonobos and baboons carry their dead babies even after the telltale smell of decomposition—to which animals are usually well attuned—has begun and the babies have started to mummify in their hands. It's maladaptive in the extreme to trudge through a jungle where predators lurk carrying several pounds of what is literally dead weight, yet mothers take the risk and expend the calories all the same. In one case in Guinea, a bonobo mother carried her dead baby for an astonishing 68 days.

"We see this a lot," says Vanessa Woods, a research scientist and author of the memoir *Bonobo Handshake*, who worked at a 75-acre

bonobo sanctuary outside Kinshasa in the Democratic Republic of Congo. "Mothers not only carry dead babies; they're very careful with them. Human mothers who stop breast-feeding early have a higher risk of depression, so maybe something similar happens with bonobos when a baby dies."

King's book tells similarly poignant tales of grief and denial across the animal kingdom. There's Willa, the Siamese cat that spent her days wandering from room to room in her home, visiting and revisiting the places her recently deceased sister Carson used to be found. There's Hachiko, Japan's legendary Akita whose grieving appeared to extend across species lines. Hachiko accompanied his owner to a Tokyo train station each morning to see him off to work and then returned in the evening to greet him. When the owner died, the dog maintained his vigil, going to the station day after day for a decade—and always plodding home alone. There are horses that lapse into apparent depression after a companion dies and even a rabbit that, after its cagemate died, "spent about a week doing tragic sweeps of the house, searching for her," according to its owner.

To the extent that it's possible to suss out scientifically what's going on in animals' heads at moments like these, preliminary evidence does point to a grief response. Stress, including the kind that follows a death, leads to the release of the hormone cortisol in animals and humans. Cortisol, in turn, can trigger the release of oxytocin, often called the "cuddle chemical." It's oxytocin that spikes in parents after a baby is born and nudges all of us in subtler ways to seek social connections and affiliation, which

"As with people, animals with strong social-support networks are buffered against the effects of stress."

—BIOLOGIST DOROTHY CHENEY

can be especially important in getting through the grief process.

Primate investigator Anne Engh followed baboons in Botswana to determine how they reacted to one of the most traumatic events an animal community may experience: the killing of one of their own by a predator. After an attack, she would collect fecal samples from members of the troop and look for signs of increased glucocorticoid (GC) stress markers. For up to a month, GC was elevated in all the individuals she tested that had witnessed the killing but was higher still in the 22 that had close family or social connections to the victim. If this led to oxytocin release, the animals would be pushed to engage in the same kind of curative gathering we practice after a death. It's stress plus grieving with a purpose—exactly the way the system is supposed to work.

"Even though they may not be aware of the responses, the responses are adaptive," says University of Pennsylvania biologist Dorothy Cheney, the co-author of *Baboon Metaphysics* and one of the researchers who oversaw Engh's work. "As with people, animals with strong social-support networks are buffered against the effects of stress."

Brain studies strengthen the case for animal grief. In humans, mourning is mediated by the frontal cortex, the nucleus accumbens and the amygdala—the last, a deeply seated structure that processes emotions. We share that basic anatomy with many other animals, though in some species the structures are poorly developed. Birds' brains don't parallel ours closely, but they do have an amygdala, and crows in particular have a large forebrain and a well-developed hippocampus, which processes memory.

Marzluff has conducted studies in which crows are captured by a researcher wearing a mask and then fed and cared for by someone wearing a different mask. Later the birds are injected with a radioactive dye and shown either the capture mask, which has stressful associations; the feeding mask, which has pleasant ones; or a third mask they've never seen, which has no associations at all. The birds are then

anesthetized and placed in a PET scanner, which reads the location of the dye in the brain.

Consistently, the crows looking at the scary mask have higher amygdala activation than the others. When the experiment is repeated but they are shown a taxidermied crow that appears to be dead, activation occurs in the hippocampus instead, suggesting that they're forming a location memory that says, effectively: This is a dangerous place; avoid it. What Marzluff would like to determine is whether crows would show emotion-laden amygdala activation as well as hippocampus activation if the dead animal they were looking at were an offspring or a mate.

"Crows form lifelong pair bonds and might be mated for 20 years," he says. "When one dies, we've seen the survivor just standing above it looking at it." Killing an animal's mate to run such an experiment is outside the bounds of decency and ethics. But anesthetizing one to simulate death, conducting the test, and then reviving and releasing them both is something Marzluff would consider. "As stressful as that would be, it might be worth it to determine if the animals are experiencing what we do," he says. (The crows might beg to differ.)

Is It the Real Deal?

Compelling as the lab work and field observations are, even advocates of animal-grief theory are wary about concluding too much. King ques-

Animals are social creatures just like we are. They form relationships that for them can appear to be every bit as important as ours are to us, which means that at some point they must experience the end of them.

tions whether bonobos or any other monkeys really do grieve, despite what the GC traces suggest. Yes, female baboons may carry dead babies for extended periods, but they have also been seen mating at the same time—hardly consistent with paralyzing grief. "Could this be natural selection pressing her not to grieve openly because it would affect her status, or was she really feeling nothing?" King asks. "I can't say."

The behavior of baboon babies may be less clear than it seems too. They have been observed standing over their dead mothers, rocking and crying, which certainly looks like grief but could also be mere hunger. When Mom dies, the milk source is cut off, and lack of food can make a baby not just hungry but also cold, which it addresses by rocking.

Crows may indeed be mobbing a corpse to pay respects, or they may simply be trying to learn what killed it so they won't wind up the same way. And as for covering the body with grass or twigs? In many species, the same death odor that baby-carrying primates ignore triggers disposal behaviors, which protect survivors from remains that could be diseased. Cats apparently searching from room to room for a dead companion may just be trying to get used to a new routine and stake out territory in a new way. Even the legendary Hachiko might have been exhibiting a love for nothing more than a routine, making a daily trip to the train station because, well, that's the way things have always been done.

Yet something rebels at so reductive a view. Animals are not insensate—less sensate than us, certainly, but able to bond and romp and care and suffer in their own particular ways. Our ability to feel, including our ability to grieve, extends far into the emotional ultraviolet, a spectrum that is surely invisible to animals. But suppose they feel only in the visible spectrum—suppose they feel only in black and white? A lesser, blunter, briefer grief is not the same as peace or joy. Grieving profoundly, King argues, is the price humans pay for caring profoundly. It's not too much to suggest that the same equation, albeit on a lesser scale, has to balance for animals too.

LOYAL TO THE END
Hawkeye, a Labrador
retriever, lies at the side
of his owner, Navy SEAL
Jon Tumilson, killed in
Afghanistan in 2011.



Why cats and dogs think differently about you

Famed animal behaviorist **Temple Grandin** explains the effects of their evolution. Plus: how to pick a cat for a pet

THE BIG DIFFERENCE BETWEEN CATS AND DOGS IS THAT cats aren't hyper-social. You can't use social approval to train a cat, and cats don't train themselves by picking up on their owners' reactions the way dogs sometimes do. Dogs serve people, but people serve cats.

On the other hand, cats are not solitary, self-sufficient loners the way a lot of people think. Cats have social needs. Unfortunately, we animal behaviorists and ethologists don't know as much about cats and their emotions as we do about other domestic animals. But a lot of what we know hasn't gotten out to the public.

One of the most important things to realize about cats is that they haven't really been domesticated, at least not nearly to the degree dogs have. Wolves started evolving into dogs 100,000 years ago. No one knows for sure when wild cats started to evolve into domestic cats. The oldest cat remains found in the grave of a human are 9,500 years old. That was after agriculture was invented in some parts of the world, so humans were past the hunter-gatherer stage. They were living in towns and villages when they started to associate with cats. The most popular theory of how cats became domestic animals is that they joined human settlements to prey on rats and mice. Basically, they made themselves into pets.

This theory may not be right, though. James Serpell, the director of the Center for the Interaction

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of Animals and Society at the University of Pennsylvania School of Veterinary Medicine, thinks hunter-gatherers may have had cats too. Archaeologists found a cat jaw in one of the first human settlements on Cyprus, when agriculture was just being invented. If the very earliest villages had cats, then hunter-gatherers probably had cats too. Serpell says that the few hunter-gatherers who are still alive today like to capture young wild animals and care for them, which is evidence that "animal keeping" has always been practiced by humans. Contemporary hunter-gatherers take really good care of these animals, don't eat them, and mourn them when they die.

If Serpell is right, cats and people could go back a very long way. But even if cats and people have lived together for thousands and thousands of years, cats probably haven't been changed that much by their association with people, because cats and humans had a mutualistic relationship instead of the more symbiotic relationship humans and dogs had during domestication. Early humans needed their dogs to guard their camps and help them hunt, and early dogs needed their humans for food and shelter. They depended on each other. With people and cats, it was more a relationship of convenience. Cats killed mice and rats, and humans provided lots of mice and rats to kill, since mice and rats lived in human settlements. The two species didn't need each other so much as profit by being around each other.

The result was that today a housecat is a lot closer to a wild cat than a dog is to a wolf. To understand why, you need to know how domestication works. The first wolves who started to live with humans would

A housecat is a lot closer to a wild cat than a dog is to a wolf.

have been less fearful of humans than other wolves. Those less fearful wolves would have been fed by humans, which would have given them a reproductive advantage over their brother and sister wolves who still had to find all their own food. That created a selection pressure for tameness.

For example, if the slower antelopes are the ones that get eaten by the lion, the faster antelopes will be more successful at breeding and will leave behind more offspring because they live longer. After a few generations, if the slow antelopes keep getting eaten at higher rates than the fast antelopes, antelopes will become faster as a species. Selection pressure is the mechanism through which animals evolve.

Humans who kept wolves would have gotten a reproductive advantage too, because they had wolves guarding them while they slept and helping them hunt. After a few generations, the less fearful wolves would be on the path to becoming domestic dogs, and the humans would probably have been on their way to becoming a species that likes to live with dogs.

Cats would have had less selection pressure to lose their fear of humans than wolves did, partly because the African wild cat, which is the ancestor of the domestic cat, has a lot less fear of humans than wolves do. There have been reports for 150 years of African wild cats living on the edges of villages and the people in the villages capturing the cats as kittens, taming them, and using them to catch rats and mice. Europeans also wrote about taming wild cats and keeping them to catch rats. The African cat didn't have to change very much to be willing to live as a housecat.

Cats did change in some ways. All domestic animals have smaller brains than their wild ancestor animals, and domestic cats also have smaller brains than wild cats, although we don't know very much about the differences at this point. Domestic animals also undergo pedomorphosis, or neoteny, and adult housecats have three juvenile behaviors: meowing, purring, and kneading their paws. Adult wild cats living in zoos don't do these things with humans, although they do purr with other cats. Other than that, though, cats are less neotenized than other domestic animals, and they can easily go feral and survive. That's not true for dogs. If you put the family poodle out in the countryside, his chances of surviving are low unless he finds another family to live with. But abandoned cats that are used to living outside may do just fine. They're healthier living with people because they get veterinary care, but they don't need to find another family to survive. They are still adapted to living in the wild and taking care of themselves. However, cats that have lived indoors all their lives may die because they have never learned to hunt or fend for themselves.

There was a second set of selection pressures on wolves and early dogs that cats didn't have, which was

Early humans needed their dogs to guard their camps and help them hunt, and early dogs needed humans for food and shelter. Cats killed mice and rats. With people and cats, it was more a relationship of convenience.

that humans started preferring wolves that were especially good at guarding the settlement or going on hunting parties with them. That would have started dogs down the path of becoming specialized for work. Cats weren't big enough to guard the humans from big predators, so there wouldn't have been any selection pressures turning them into guard cats, and there wasn't any reason for humans to choose the best mice and rat killers because all cats naturally kill mice and rats and any other small prey they can catch.

Even without knowing anything about the history of the domestic cat's evolution, you can tell from the cat's appearance and behavior that cats haven't changed as much as the other domestic animals have. In appearance, domesticated animals are much more varied than their wild counterparts. Dogs have huge variability, ranging all the way from tiny toy breeds to Alaskan malamutes. Cats don't come in anything like this kind of variety. They've evolved some differ-



Meh

You like me,
you really like me!



CONVENIENT COEXISTENCE African wild cats often live near villages, where there is an abundance of mice and rats, and humans have long taken advantage of their hunting instinct.

ent coat colors, but most people looking at photographs of wild African cats wouldn't be able to tell them apart from a standard tabby cat.

There are at least three reasons why domesticated animals have more variability in appearance, which probably apply more weakly to cats than to the other domestic animals. First, humans usually protect domesticated animals from predators, so selection pressures for protective coloring go down because genes for coat colors that make the animal easier to see don't get culled out of the gene pool. Second, the genes for appearance are usually connected to behavior in some way, so as different behaviors develop in a domesticating animal, appearance changes too. I'll talk more about the relationship between a cat's coat coloring and its behavior later on.

THE THIRD REASON WHY THERE'S SO MUCH VARIABILITY IN domesticated species is that humans deliberately breed domesticated species to be more variable. That's the second stage of domestication. At first domestication happens naturally when some of the animals living with humans (the good guard dogs and the good hunting dogs) reproduce more successfully than others (the guard dogs and hunting dogs that got killed). Then, once humans developed selective breeding techniques, they began to breed differences into domestic animals on purpose. Dogs and horses were bred to do particular jobs; cows, goats, sheep and chickens were bred for production traits such as how fast they grew, how much meat and fat they had, and so on. People have been selectively breeding cats only for the past 150 years or so, and purebred cats are being bred for appearance traits instead of work or production traits.

There's also a big behavioral difference between cats and the other domestic animals, which is that you can't train a cat using punishment and negative reinforcement. That makes cats more like wild animals than dogs or horses or cows. Karen Pryor of the Karen Pryor Academy for Animal Training & Behavior in Waltham, Mass., has a really good description of how wild animals react to punishment or force:

"Anyone who has ever kept a wild undomesticated animal for a pet knows that they are more difficult to train. It is extraordinarily difficult, for example, to teach a wolf to walk on a leash, even if you have raised it from puppyhood and it is quite tame. If you pull, it pulls back automatically, and if you are too insistent and

pull too hard, the wolf, no matter how calm and sociable it usually is, panics and tries to escape. Put a tame pet otter on a leash, and either you go where the otter wants to go or it fights the leash with all its might.

"Dolphins are the same. Push a dolphin and it pushes back. Try to herd dolphins from one tank to another with nets; if they feel crowded, bold individuals will charge the net and timid ones will sink to the tank bottom in helpless fear."

The only way to train a wild animal is to use positive reinforcement. Positive reinforcement means rewarding the animal for doing the things you're training it to do. Cats are the same way, which is probably why people have always thought cats weren't trainable. Traditional animal training relies on punishment and negative reinforcement. The punishments and negative reinforcements might be extremely mild, but they're still negative. For example, putting a collar on a puppy and pulling on the leash to get him to walk with you creates a slightly unpleasant pressure on the puppy's neck. The puppy learns to walk forward to get away from the pressure. That's what negative reinforcement is: an animal or person is reinforced by having something negative (pressure on the neck) stop. You can't train a cat to walk on a leash by putting a collar on it and dragging the leash. But you can train a cat to walk on a leash by using positive reinforcement.

What it all comes down to is that a cat in a person's house isn't all that different from a cat on the Serengeti Plains. Nicholas Dodman, a veterinary researcher who wrote *The Cat Who Cried for Help: Attitudes, Emotions, and the Psychology of Cats*, says, "A cat is in some ways like a miniature tiger in your living room."

Cats Are Hard to Read

I started out this chapter by saying cats are more social than most people realize. One of the reasons people haven't picked up on cat sociability is that domestic cats aren't totally domesticated the way dogs and horses are. They can go their own way. Quite a few cats do go. A friend of mine told me that her favorite cat when she was growing up, a big, striped tomcat named King, moved to the neighbor's house down the road. They'd see him every once in a while when he came back to visit, but otherwise he stayed with the neighbors. My friend grew up on a farm where all the cats were barn cats, so her parents figured King must have gotten promoted to housecat with his new family. He had a better offer and he took it. A dog would never do that.

The other reason people see cats as being more solitary than they are is that cats have less in common with people as a species than either dogs or wolves do, regardless of domestication. Wolves live in families with a similar structure to the human family, and wolves' communication is probably a lot more like human communication than cat communication is. Wolves communicate heavily through vision, and their faces are very expressive. Thanks to domestication, dogs also make lots of different sounds people interpret pretty well. For instance, dogs "talk"—or bark—because they evolved to live with people, and people communicate through sounds. Wolves are mostly silent. Adult wolves almost never bark.

Dogs also read humans well. There's a lot of research on that.

Cats are completely different, and I think their differences make them difficult for people to read. The hardest thing for people is that cats don't have expressive faces. Humans naturally look at an animal's face to see what it's thinking because people are primates, and primates use their faces to communicate. Some anthropologists think facial expressions are more important than words, even. Looking at an animal's face works just fine with a dog, although you need to look at its posture and its tail too. But cats don't signal with their faces very much, and they have lots more bodily signals than either dogs or wolves do. So when people look into their cats' faces, they're looking at the wrong place.

Another interesting thing about cat faces: Cats don't have eyebrows the way people and a lot of dogs do. Eyebrows probably evolved to highlight facial expressions, and a lot of dark-furred dogs have little round light spots right over their eyes that may have evolved for the same reason.

I think the cat's inexpressive face is one of the reasons some people think autistic kids are like cats. There's even a book called *All Cats Have Asperger Syndrome*. Cats seem autistic because they don't come across as being sociable or eager to please like dogs, and also because their faces are kind of blank. Autistic

people often have somewhat blank faces too.

Cats probably don't read people's faces very well either. In his book, Dodman has a story about a cat who was badly scared one day when he saw a man beat his dog right outside the sliding glass window that the cat was sitting next to. The man was tall, thin and had a beard. Later that day the cat attacked his owner, who was also tall, thin and had a beard, so it's possible he mistook his owner for the other man. A dog wouldn't have made that mistake.

The final reason people have trouble understanding cats is that humans probably can't even perceive a huge number of the signals cats make. Cats use smells to communicate with each other, and humans have a terrible sense of smell compared with cats. Researchers say that cats may have as good a sense of smell as dogs, who can smell things at a threshold of a thousand parts lower than people can. Of course, everyone can smell it when a cat has been spraying the furniture, but there are probably all kinds of subtler smell signals inside those big, horrible smells that other cats can pick up on but we can't.

Cats definitely communicate with other cats by leaving odors human can't smell. They have at least two ways to do this. One: Cats have glands on their paws that leave a deposit whenever they scratch an object. Two: Cats have facial glands that leave deposits when they rub against things. Dogs mark by peeing on stuff, but that's all. They don't rub against people or knead people with their paws to leave their scent.

Given the fact that cats do so much "talking" in smells, it isn't really surprising that the number-one behavior problem cat owners go to vets for help with is elimination disorders.

That brings me to the core emotion systems in the brain.

The Blue-Ribbon Emotions in Cats: The "FEAR" System

Fear can be a big problem for cats, which is probably why we have the expression scaredy-cat. A lot of housecats are so afraid of strangers that they hide anytime someone comes to visit. I wonder whether this is because cats are genetically closer to their wild counterparts. A wild animal is afraid of people. That's one



TRUE COLORS Studies have shown that a cat's fur may be linked to its disposition. Black cats tend to be more sociable and more adaptable to urban life, whereas orange cats are shier and more easily startled.



of the things that makes it wild. It's possible cats naturally have more fear of humans than dogs do because they're not as fully domesticated.

It's easy to tell when a cat is afraid. Fearful cats avoid the thing they're afraid of however they can. A housecat runs and hides. At the zoo, when the big cats are afraid, they refuse to go out to the exhibit area. A cat that is only feeling fear doesn't puff out his hair, arch his back and spit. That's an angry cat. The "FEAR" system can activate the "RAGE" system in all animals and people, so a frightened cat can become enraged. But as long as he's only feeling fear, he doesn't puff up his hair or attack.

Three different studies have found that cats can be divided into two personality categories: bold and shy. The researchers who did the three studies called the bold cats confident, easygoing, sociable and trusting; they described the fearful cats as timid, nervous, shy and unfriendly.

Boldness and friendliness go together. Bold cats are faster to approach a novel object than shy cats, and they are friendlier to people. So if you want a naturally friendly cat, you could consider getting a cat from a breed that's known for being friendly. The Siamese breed is a good bet. In one survey of people who owned Siamese cats, Persian cats or nonpedigree cats, both the Siamese and the Persian were ranked as being friendlier than the domestic cats. The authors of the survey also observed the owners with their cats and found many of the same differences the owners reported.

A Cat-Buyer's Guide

If you're going to get a domestic cat, there are three things you can do to obtain a cat with a friendly, bold temperament:

1. Get a kitten and make sure lots of people gently handle it when it's tiny. The sensitive period for socialization is the second week of a kitten's life to the seventh week, and the more people who handle the kitten during this time, the better. This is very important, because it's so easy for cats to go feral. My friend Mark's cat once had kittens underneath his house where he couldn't find them. By the time he finally discovered where they were, the kittens were way over two months old and were super-wild. He couldn't handle them.

I've seen the opposite happen, too. I went to a livestock auction on a day they weren't having a sale, and I found a mama cat and her kittens living underneath the auctioneer's stand. Those kittens had been handled by everyone at the auctions, and they were the friendliest, cutest little kittens. Kittens need a lot of friendly human handling during the sensitive period.

2. If you adopt a kitten from a shelter, pick one that is friendly. I've gone to a number of animal shelters and visited the cats. If I put my hand in the cage, some kitties come right up to me and rub me, while other kitties huddle back. The kitty that comes right up to you is the kitty you want.

A lot of shelters have a room where you can get to know the animal, so you can watch to see how a cat acts when you take him into the room. If the cat lets you hold him, that's a good sign. You could also take a cat toy in to see whether the cat plays with it. There's a wonderful little cat toy I really like: a little feather duster attached to a flexible 18-inch wand. Cats just love it.

3. Adopt a black cat. Sarah Hartwell, a shelter worker in England, calls black cats "laid-back blacks" and tortoiseshell cats "naughty torties." That description is supported by a handful of studies showing a relationship between fur color and behavior. Black cats especially are friendlier than other cats, are better able to deal with crowding and urban life, and have greater aggregative tendencies, which means they're more inclined to live in a group of cats. Black cats are more social overall, whether it's with other cats or with humans. Other studies have found that orange male cats are more aggressive than black male cats. That's logical, because orange cats are shier than black cats, and you would expect fearful cats to have more fear aggression. I've noticed that neutered orange males and females can be very affectionate. Some orange cats will rub on you all day. However, orange cats startle and scare easily.

Fur color isn't a guarantee that a cat will have one kind of personality or another, so adopting a black kitten doesn't mean you've definitely got a cat that likes to live in groups, including groups of humans. When you choose a kitten, you have to go by the individual personality of the kitten, regardless of color.

Animals talk, even if we can't understand them

Dr. Dolittle was hopelessly naive. Worse, he was presumptuous. "Talk to the animals," indeed. First of all, there's his choice of preposition: talk to the animals, not with the animals, as if the animals would listen, would have little better to do than pay attention to what a human being had to say, rather than focusing on the hard work of surviving and thriving in their own complex and dangerous worlds. Dr. Dolittle can talk all he wants, but odds are the critters aren't interested.

The good thing, of course, is that Dr. Dolittle isn't real. The bad thing is that we've all got a lot of him in us. You may love animals, care about them and, if you're a pet owner or farmer or veterinarian, may even spend a great deal of time with them. But the conversation, to the extent that one exists, is usually one way—us to them—and expressed in the way we know best: with words, just a few of them, enunciated clearly, repeatedly and often loudly. There's sit and stay and come and bad and fetch and go and no, and if the animal doesn't understand much more than that (and really, why should it understand much more, since it's, well, an animal?), we roll our eyes bemusedly, give the beast a scratch behind the ear, and say to another human nearby, "Not exactly an Einstein, is he?"

WHO'S SCHOOLING WHO?

Like Dr. Dolittle, our desire to talk to the animals is sincere. But this urge to communicate has always been on our terms.

Well, no, he's not. But you're not exactly a dog or cat or cart horse or monkey, and there's no greater or lesser shame in that fact. Just as we look at animals in confusion or indifference as they emit their strange barks, yelps, squeaks and chirps, so they look at us. We are gesturers and noise-makers to them, little more.

That's not an idea we readily admit. There are many things human beings prize in our vast repertoire of capabilities, but perhaps none more than our power of speech. We communicate with a symbolic language built of innumerable combinations of sounds, each with a distinct and often exceedingly subtle meaning. We express them with a voice capable of uncountable ranges and tones, and listen with ears and a brain able to make sense of it all. And since just one mode of making ourselves understood isn't good enough for an incandescently brilliant species like ours, we convert the same information into scribbles and glyphs so that a fleeting insight today can be preserved forever, becoming part of the species-wide knowledge base tomorrow. Top that, non-verbal species.

But the thing is, nonverbal species often do top that, though not in ways we always notice or value. Sure, we can communicate in thousands of different tongues, but that's because we have tongues, as well as larynxes and palates built around forming words, to say nothing of a superior temporal gyrus and an inferior frontal gyrus, which make it possible to understand language, the innate sense of grammar that gives order to it all. And then, too, there are our famous opposable thumbs, without which we could not use the quills or pencils that make written language possible.

But you know what we don't have? We don't have the sonar systems dolphins and bats do, allowing them to echolocate and communicate at frequencies we can't even hear. We don't have the exquisitely sensitive olfactory systems of dogs and sharks and moths, allowing them to detect just a few molecules of scent on the wind or a tree or in the water. We don't have the flashing abdomens of the firefly, blinking elaborate Morse code in the night, or the stridulating structures on the legs of crickets, with which they keep up their ceaseless nighttime chatter. We don't pant-hoot like chimps or chirp songs like birds or slap

our flippers and flukes against the surface of the ocean, all of which are forms of conversation that can be dense with information.

We are, truth be told, extremely limited creatures, communicating in just a narrow range of all the communicative possibilities—a hard fact that Dr. Dolittle himself seemed to understand. He dreamed, after all, of “chatting to a chimp in chimpanzee”—not in English or French or any other human language that the animals have no need for because their own languages suit them perfectly well. The gorilla that can master American Sign Language or the bonobo with a nearly 400-word pictographic language or the parrot that knows, and can speak, dozens and dozens of words rightly wow us. But all that is the result of their being taught to do what doesn't come naturally to them, which means they will never do it very well. It's nothing compared with the multiple languages the animals are already speaking. The harder we listen, the more we can appreciate the music of it all.

Where's the Respect?

One of the biggest obstacles we confront in appreciating animal communication is, paradoxically, the very language we use to describe it. Edward O. Wilson, the legendary biologist, entomologist and Pulitzer Prize-winning author, once described animal communication as “the action of or cue given by one organism [that] is perceived by and thus alters the probability pattern of behavior in another organism in a fashion adaptive to either one or both of the participants.”

Not much room for poetry there, yet the exact same description can apply to all human communication too—to the police officer who shouts “Freeze!” at the fleeing purse snatcher, the customer who places an order in a restaurant, the professor conducting a question-and-answer session at the end of a lecture, the person who whispers “I love you” to another. At least one party, and usually all parties, to these communications will benefit: the lover gets a kiss, the student gets wisdom, the customer gets a sandwich, the criminal doesn't get shot.

Animals do similar things, and in some ways more elegantly, without a word ever being exchanged. Consider the springbok, a species



SOCIAL MEDIA
To our human ears, a roar is a roar, but to other lions the roar carries information vital to the well-being of the pride.



THE MANY CALLS OF THE WILD Wildlife filmmaker Martyn Colbeck has spent years among elephant herds identifying 70 distinct vocalizations that range from the celebratory to calls to mount a search and rescue.

of small antelope in the Kalahari desert, that doesn't break into a simple run when it's fleeing a predator but instead punctuates its stride with something called stotting, leaping high into the air in a bit of exhibitionism that costs calories and reduces speed but that also sets it apart from the other members of the herd, who are stotting too but maybe not achieving the same height. This, writes author Stephen Hart in his book *The Language of Animals*, "communicate[s] their excellent health to predators. The springboks appear to say 'There's no use chasing me, I could obviously outrun you.'"

Killdeer, a species of shorebird, are similarly good signalers, protecting their nests from predators by flopping on the ground and faking a wing injury. This creates the impression that they're easy prey, allowing them to lead the predator farther and farther from their vulnerable chicks. When the killdeer has lured the predator a sufficient distance, it takes wing and flies back to its babies. Predatory fireflies can mimic the flashing pattern of female members of nonpredatory species, attracting prey males by posing as a potential mate. But most of the males land just out of reach, getting a closer look at the flashes or perhaps catching a whiff of the bug doing the flashing in

order to confirm its authenticity. All of this is communication—and all of it is lost on us.

"There certainly are modes of animal communication to which we are completely deaf, [like] the vibratory signals leafhoppers send to each other through a plant stem, the electrical signals of mormyrid and gymnotid fish, the wavelength of colored signals we cannot detect," says Jack Bradbury, an emeritus professor of ornithology at Cornell University. "The chemical signal repertoires of social insects are well known as being very complex."

The deafness Bradbury speaks of is sometimes a literal deafness, and it's one of the most striking examples of the limitations of our anatomy that hobbles us in our attempt to hear and speak animalese, in the same way animals' lack of speech organs hampers them. Humans can hear in what seems like an impressive range of frequencies—from 20 hertz (or vibrations per second) to 20,000. But bats, dolphins and some insects may quadruple that, going as high as 80,000.

"From my perspective, I can give just as high marks to the high-frequency communication bats use to navigate, forage and communicate as I can to the songs of whales," says ecologist John Christy of the Smithsonian Tropical Research In-



SEEING IS BELIEVING A healthy springbok shows potential predators how high it can leap in the air. The behavior, called stotting, conveys the message "There's no use chasing me—I could obviously outrun you."

stitute in Panama. "All are remarkable, understood only partly, and all are of value."

Overlooking the Evidence

Even the forms of animal communication we do perceive, we often fail to appreciate fully. Much is made, rightly, of the complexity of the bee dance, with which honeybees communicate both the existence of and directions to a source of nectar. A round dance indicates a relatively close source—within 80 feet. A dance that includes a waggle of the abdomen indicates a more remote source. Even the quality of the nectar is conveyed by the number of times the signaling bee changes direction in the dance. All of that seems pretty complex for a species with such a tiny brain. And none of it takes into consideration that the dance is typically performed in utter blackness inside the hive, which means the other bees must stand just close enough to feel the signaler as it brushes past without getting in its way. Humans may glimpse the bee dance when they open a natural hive or pull out a panel of an artificial one, but for the bees, it's all about touch.

The conversations among dogs also go over our heads, even if we flatter ourselves that we understand everything there is to know about them.

Yes, a growl or a whine or a volley of aggressive barks are all pretty straightforward and limited means of self-expression. But the dog's body says much more: the signature play pose—with the head and forelimbs low and the hindquarters up in the air—is an unmistakably happy signal. So is the wagging tail, but here things are more complicated than we think. A wag that's low and relaxed may indeed signal the happiness it seems to convey. But a high tail, wagging quickly, may signal agitation.

Patricia McConnell, an animal behaviorist and adjunct professor of zoology at the University of Wisconsin–Madison, has found that some signals between dogs last only a tenth of a second and involve a change in posture of only a quarter of an inch, yet they convey volumes about social status, potential aggression or mating interest. Dogs are equally adept at reading cues coming from us: leaning forward just half an inch may be enough to carry a flicker of menace and discourage a dog from approaching, while leaning back by the same small amount may encourage an approach.

The horse known as Clever Hans was another master of body language. Owned by a German mathematics instructor in the early part of the 20th century, Hans was said to be able to under-



DECEPTION AND DANCE *Predatory fireflies use light to attract and then eat would-be Romeos; killdeer fake injuries to lure predators away from nests; and honeybees dance to give directions to flowers.*

stand complex human commands, including instructions to add and subtract, by tapping its hoof a certain number of times to indicate the correct answer to a question. As it turned out, the horse was not doing arithmetic at all but rather was simply reading the subtle changes in its owner's posture as he would tense up when Hans approached the correct number of taps and relax when he stopped without exceeding it. But there's nothing at all counterfeit about the two-way communication that was going on, provided you looked at it the right way.

"People at the time stood ready to believe that Hans could understand human speech and carry out verbal commands," writes Hart. "But they declared Hans a fraud and lost interest when skeptics revealed that the horse was 'only' exquisitely sensitive to human body language—a means of communication of which we are only vaguely aware."

Elephants are far more voluble beasts than

horses, clever ones or otherwise. Wildlife filmmaker Martyn Colbeck has spent years among elephant herds, most notably for a film he produced for the PBS network, and identified no fewer than 70 distinct vocalizations with 70 distinct meanings. Like bats and dolphins, elephants sometimes communicate at frequencies that are entirely inaudible to humans, but in this case it takes place at the far low end of the spectrum, from 1 to 20 hertz, rather than the high end.

Some of the elephants' vocalizations are contact calls, with one type of rumble used to establish the caller's location so that a herd of dispersed elephants doesn't lose track of one another, and another, slightly different one used by a lost elephant when it needs help. There are "let's go" rumbles a female will produce to get a herd of other females and their babies moving; there is a repetitive alarm blast by an adult that will rouse the other adults when a predator approaches, signaling them to form a protective circle around the calves; and



DOWNWARD DOG While some poses and postures can be open to interpretation, hindquarters-up always means only one thing: let's play!

there are signature flirtation calls males emit when they're ready to mate and females use to signal receptivity—often across vast expanses of wilderness. There is also celebratory trumpeting, and an entire herd chimes in when some of its members have been absent and then return.

The King's Speech

Of all animals, there may be none so creatively expressive as dolphins, with their whistles, chirps and clicks, many of them audible to us, and their sonar signals, which we can't hear at all. Individual pods of dolphins will develop signature clicks in signature intonations that all of them will learn and pass onto their calves, a form of regional dialect unique to them. Some of the signals serve to establish the identity of individuals, sort of a sonic name, that they will call out to one another across long distances.

Dolphin clicks can be emitted slowly and individually or in pulses of 200 clicks per second, a vibrating train of sound used more for echolocation than communication. Clicks that are faster still, as rapid as 2,000 pulses per second, come in such quick succession that even to the dolphins themselves they may simply run together into a single sound. These so-called burst pulses are used almost entirely as a form of communication—and not a pleasant one, either—produced by one male to threaten another, say, or an angry

mother to scold a wandering calf.

All of that is in addition to dolphins' rich vocabulary of body language, including tail slaps against the water surface that may either convey aggression or alert a pod that it's time to leave an area; jaw claps that signal either aggression or play, depending on who's doing the snapping and at whom; and breaches, when the dolphin leaps high out of the water and crashes back down, thought to indicate the individual's location and the general direction it's traveling. Such extensive physical and acoustical chatter is essential to maintaining what dolphin experts call the animals' fission-fusion society, with long-term, stable relationships developing among family members and female friends within pods, as well as transient, utilitarian ones among males that collaborate to hunt or repel a predator but have little to do with one another once the work is done.

"This demonstrates the dolphin's very sophisticated communication system as well as a very broad intelligence," says behavioral biologist Toni Frohoff, co-author of the book *Dolphin Mysteries*. "They need to recognize each other and find each other, because they're breaking apart in groups and coming back together."

As with all matters animal, it is possible to make too much of even the most remarkable stories of communication among the nonverbal beasts. There are, surely, limits to the richness of elephant trumpeting; alert calls and rallying cries are important forms of exchanging information, but they aren't poetry and never will be. Dolphin clicks and whistles may be much more complex, but they do not convey great philosophical insights—or at least there is no evidence that they do.

But animals communicate in ways that are suited to their worlds, that keep them fed and safe and alive long enough to reproduce and rear their young. Among the higher of those animals, if not among the chemically signaling insects, such forms of communication must also enrich those worlds. There is no reason to believe that a dog assuming a play pose or a herd of elephants trumpeting at a reunion do not experience much of the same joy we do when we behave in similar ways. As with us, too, the very act of expressing that joy—through our cheers, hugs, whoops and words—makes the feelings more powerful still.



Of all animals, there may be none so creatively expressive as dolphins, with their whistles, chirps and clicks.

The cuteness factor

It's no accident that some animals make us smile and coo. Just as large eyes, small noses and wobbly movements have us infatuated over human babies, similar infantile characteristics in animals provoke an instinct to nurture and protect. Cuteness like this even has a name: neoteny, or the persistence of juvenile traits in adulthood. In terms of evolution, neoteny not only prompts a parental response but extends the crucial pre-maturity period of brain development, possibly making some species (like humans) smarter. In other words, natural selection may amount to survival of the cutest.



WORRISOME BEHAVIOR

Gus, a polar bear euthanized in 2013, obsessively swam laps in his pool at the Central Park Zoo, which spent thousands of dollars to treat him.



Mental illness is not just for humans

never imagined I would see a crazy dolphin, but I did—just once—a number of years ago. It's the kind of memory that tends to stay fresh.

I was in a water park in Mexico City—a place more modest than giant operations like SeaWorld or Six Flags, with a limited number of animal displays but a lot of splashing, spraying and wading activities for kids. Somewhere in the center of the park was a cement expanse that drew surprisingly little foot traffic given the size of the crowd that was circulating everywhere else. In the middle of the expanse was a small, circular pool, perhaps 12 or 15 feet across and five or so feet deep. And in the pool was a single dolphin. It was impossible to tell the animal's age, it was impossible to tell its sex, but it was impossible not to read its state of mind.

The dolphin did just a single thing in the time I watched: it swam in a repeated circle around and around the perimeter of its pool. It did not slow in the time I was there; it did not stop or alter its course by so much as a degree that I could see. If it's alive today—and it would be a mercy if it isn't—it may still be swimming. That dolphin, by any apparent measure, was clinically insane, driven mad by its terrible confinement.

The animal mind is an unknowable thing. Only the animals themselves



TORMENT IN A TANK SeaWorld has come under scrutiny after Tilikum, a captive male orca in its Orlando, Fla., park, was involved in the death of a third person, trainer Dawn Brancheau, left, in 2010.

are aware of what they're thinking and feeling, and they're not telling. But the mind of a human baby is unknowable in the same way, yet we learn a lot by watching. We know when a baby is happy, when it's sad, when it's frightened, and we know when it seems to be feeling things that we don't quite grasp but that appear to be troubling it terribly. If a baby could go crazy—and some are surely more anxious or psychically fragile than others—we'd be able to intuit that too.

So it is with animals, and the ones we encounter closely enough to observe have more reasons to go to pieces than others. Animals in

the wild live lives they're intended to live. Animals forced to interact with us live very different ones. They live in our homes, zoos and amusement parks. They are kept on farms and in paddocks, stables and labs. They live in cages and pens and brood crates. And they are trained, often forcibly and violently, to do things they do not want to do: to pull carts and drag logs and dance and leap and fight with one another in pits and rings surrounded by screaming people whose minds and motivations they can't begin to understand.

And so they go nuts. Animals that live in zoos sway, pace or sink into languor. Parrots in cages tear at their own feathers. Abused dogs retreat in terror at the sight of a human hand. Chickens on industrial farms peck each other to death. Gus the polar bear, the famed attraction at the Central Park Zoo in New York, swam in robotic laps back and forth in his small



pool, both drawing crowds who came to see his strange behavior and then driving them away when they realized that what seemed strange was really very sad. Gus died in 2013, and many people concluded that it was just as well.

Tilikum the orca lived up to the "killer whale" misnomer by which many people identify his species when he dragged Dawn Brancheau, a 40-year-old trainer, to her death in 2010, grabbing her braid in his mouth and pulling her underwater. It was, astonishingly, the third death in which he had been involved, including another trainer in 1991 and a trespasser in his pool in 1999. Tilikum is still alive and, presumably, still armed with his anger. To scientists, the reason is not an enigma.

"I wouldn't consider this aggression," says behavioral biologist Toni Frohoff, co-author of the book *Dolphin Mysteries*. "To me, it's probably the most clear case of post-traumatic stress disorder. You know, there's fight or flight. So let's say Tilikum is exhibiting fight because there's no capacity for flight."

For some people, incensed at the idea of a killer whale that actually kills, that may smack of sympathy gone wrong. But the fact is, in the same way hard lives turn people hard—unbalanc-

DOG, INTERRUPTED Canines become socialized between four and eight weeks old. Those taken from their mother and siblings before this crucial period—often the case at abusive "puppy mills"—can grow up with disorders.

ing them, destabilizing them—so too can it be with animals. The more scientists consider the madness of the beasts, the more they discover it is a very real thing, with all manner of animals suffering all manner of disorders. That, in turn, has led to the development of treatments and therapies—occupational, behavioral, even pharmaceutical—that may set things right. The brain is the most complex organ in the body of any species that has one. Like our brains, animal brains can break down and can also be healed.

Misreading the Signs

As obvious as animal madness can seem, and often is, that doesn't mean we never misdiagnose what we're seeing. The beast has not been born that can fill out a personality questionnaire, which means we must lean especially heavily on observation, and that's an imperfect process. Take the oft-told tales of dogs and cats with OCD.

Obsessive-compulsive disorder is a comparatively common problem among humans,



DEEP-SEATED DAMAGE Orphaned elephants and baby rhinos at the David Sheldrick Wildlife Trust near Nairobi National Park in Kenya are treated for post-traumatic stress and depression.

one that has a great many ways of manifesting itself. One of its less familiar expressions is hair-pulling: the repeated plucking of hairs on the head and even the eyebrows and eyelashes, resulting in thin or bald patches and a lot of suffering on the part of victims who dearly want to stop, and can't. Among dogs and cats, similar symptoms present themselves, but since they can't pluck at their fur, they obsessively lick or chew their paws or other parts of their bodies, resulting in similar balding, as well as raw skin and even infection. So OCD, right? Maybe not.

Bonnie Beaver of Texas A&M University, the executive director of the American College of Veterinary Behaviorists, likes to tell the story of a 2006 study in which researchers wanted to learn about what they called "psychogenic grooming" in cats. The belief, she says, was that "the cats were anxious, and so instead of twirling their hair or biting their fingernails, they groomed excessively."

A sample group of 21 symptomatic cats were recruited for the study, but before they could proceed to the second phase, they had to be screened for dermatological diseases to rule out the possibility that they simply had a rash or some other kind of uncomfortable condition. The result? "Nineteen of 21 cats had a derm problem," says Beaver.

This kind of misinterpretation bedevils animal behaviorists and well-meaning pet owners all the time. A dog exhibits all the signs of sadness and so humans determine that that's what it must be feeling, for example. "But just because the animal has their head down, maybe their eyes partially closed, does not necessarily mean they're sad," says Beaver. "They may have a headache. We don't even know if they get a headache."

Birdsong, similarly, sounds happy to us, so we assume that's how the animals producing it are feeling. But a song to your ears may be a threat or distress call to another bird's. A

dolphin's mouth is fixed in a permanent smile and the clicking, chirping sounds it produces seem to fit the expression, so we assume they're an innately good-natured species. But suppose the random mutation that turned their mouths up instead turned them down, and suppose they chirped in a lower register? So much for happy.

Still, the fact that mistakes are sometimes made doesn't remotely mean they always are. And indeed, it wouldn't make neurological sense if nonhumans couldn't suffer a range of disorders almost as wide as the ones that plague humans. The brain of, say, an ant or a worm may be radically different from ours—just a few neural strands and little more—but move up the scale of complexity, and a great many of the lobes and other structures that exist in our species are present in others, especially in mammals.

"A dog is the same bunch of chemicals we are," says Marc Bekoff, a professor emeritus of ecology and evolutionary biology at the University of Colorado, Boulder. "He just happens to have the genes of a dog. Since all mammals share the same structures in the limbic system for emotions, there's no reason to think that nonhumans don't go crazy."

If that's true, the question becomes exactly what drives them to that breaking point. Abuse and trauma can certainly do that job. Dogs returning from Iraq and other wars exhibit signs of post-traumatic stress disorder (PTSD)—jumpiness, anxiety, poor sleep and loss of appetite—and how could they not? An explosion is an explosion whether you're a canine or a human, and repeated explosions take their toll. So too does the smell of blood and an environment of fear and combat. We prize dogs precisely because they read us and understand our feelings so well. Even if they're not experiencing precisely what the combat soldiers around them are, they read those experiences in them.

PTSD has also been observed in other animals, particularly elephants and whales. Elephants establish deep, generations-long family ties and famously mourn their dead, lingering over carcasses long after all hope is gone and examining and caressing bones they find in their wanderings. Elephants captured in the wild are frequently babies that have witnessed the slaugh-

ter of their parents and other members of the herd, often for their ivory, and those are experiences that are hard to shake.

The Sheldrick Elephant Orphanage for elephant calves and baby rhinos was established near Nairobi National Park in Kenya to care for and rehabilitate animals that have suffered that kind of trauma, and although the results of the treatments are sometimes good, often there's just not enough of the babies' psyches to save. "The animals I met there, I just can't even put in words how far gone they were," says Bekoff, who has visited the facility. "They've either seen, heard or smelled family members being killed, or they haven't experienced that but they've been left alone."

Tilikum, with his three-murder rap sheet, may not inspire much compassion, but he had an even worse time of things before he was pulled from the sea. "He witnessed a horrific slaughter and brutal capture of his family, and experienced isolation in captivity and endured things that we would consider torture if it happened to humans," says Frohoff. "So, considering all those factors, the fact that there's any remnant of a functional orca in him could be a testament to his strength."

Something similar may be at work with chimpanzees, lions and even dolphins that attack humans—with whom they shouldn't be having much interaction in the first place, much less an interaction in which the humans cage them and train them and control every aspect of what was supposed to have been their wild lives. "Orcas and dolphins haven't been domesticated genetically," says Frohoff, "so even the most well-trained dolphins are highly unpredictable. You don't see groups of dolphins in the wild beating people up."

The comedian Chris Rock came at the idea in a decidedly less scientific way, after a trained tiger attacked and mauled the illusionist Roy Horn during a Siegfried and Roy show in Las Vegas in 2003. Mystified by the violence that the animal exhibited after so many peaceable years, many people concluded that it had somehow "gone crazy." Not so, Rock insisted. "That tiger went tiger!"

Fixing the Problem

Helping the psychologically ill animal is no easier than helping the psychologically ill human—harder

however, any recovery may be impossible. The ideal period for socialization of a dog comes very early in its life, at just four to eight weeks of age. Filling that period with terror and suffering may simply leave too much emotional scar tissue.

"Dogs that have been mentally abused, that have been beaten and that kind of thing, they may be desocialized," says Beaver. "You can't resocialize them once that happens, because they passed that golden time period in life when socialization occurs."

For other animals, psychotropic drugs may help, and while the very concept of Prozac for your pet makes some people laugh or roll their eyes at such anthropomorphic pampering, there is, again, no reason the meds shouldn't work at least some of the time. If both dogs and humans have similar brain chemicals, and manipulating how they get taken up or blocked improves mood in humans, why shouldn't it in animals?

From Beaver's experience, about 20% of animals are helped by taking appropriate doses of psychotropic drugs administered under the guidance of a veterinarian. That's not a figure that inspires a ton of hope for recovery, but it's a good deal better than 0%, and for animals whose owners have tried everything else, it's a very attractive option. What's more, the way drugs are tested and approved for humans actually gives animals a head start on taking them. "Because most medications that come to market have already gone through animal studies," says Beaver, "we have some background on them."

For zoo animals, other kinds of therapy are available, mostly involving what's known as enrichment. The days of tigers and elephants being kept in small, barred cages may be over in most of the world, but the pretty enclosures in which some animals are confined today—designed to look like a wild habitat, even if only a small patch of it—can be misleading.

"That does not necessarily mean anything to the animals," says Beaver. "It looks good to people, but unless it provides something additional for the animals to do, it's not enriching." Valerie Hare, head of the nonprofit group Shape of Enrichment, which consults with zoos, farms and other opera-



MYSTERIOUS HABITS Obsessive self-grooming could indicate either mental distress or a physical ailment.

even, because the staple of human recovery, talk therapy, is clearly off the table. But other kinds of treatment are available.

The rehabilitation practices at the Sheldrick sanctuary are slow and painstaking, involving the same kind of behavioral experiences that help traumatized humans rediscover that the world can be a safe place. "What I saw at Sheldrick was just amazing," says Bekoff. "What it consists of, mostly, is just really hanging out with the elephants, rubbing them. I have a picture of this guy putting his hand in their mouth. It's oral. It's soothing. And it's getting their trust back."

Dogs like the ones recovered from the dog-fighting ring operated by NFL player Michael Vick were put through a similar rehabilitation that consisted mostly of teaching them to trust the new people they were getting to know and to interact with them. They may never be able to engage similarly with other dogs, especially other pit bulls, since they were bred to fight one another in the first place and then those traits were brought out by training. For some of them,



OUT OF THE WILD A Shanghai zookeeper was mauled to death by this South China tiger in 2013 when he entered the animal's enclosure to clean it. In 2003, Oxford University researchers found that large carnivores that naturally roam large areas are at an especially high risk for psychological stress in captivity.

tions to improve the lives of the animals kept there, believes that successful enrichment must involve some change in the environment that the animal can perceive and care about, and it must be something with which the animal can interact.

That may involve hiding food around an enclosure instead of just serving it up on a platter, requiring the animal to forage and experience a sense of reward for its efforts. Gus the polar bear was given food frozen in blocks of ice that he had to work to reach and eat, a more distracting and engaging way for him to get his dinner than if trainers simply threw him fish.

"We say we're going to make them work for their food," says Hare, "but if they don't do the work, we're still going to feed them. We're giving them a sense of control over some aspects of their environment."

Environmental enrichment can be surprisingly cheap. Hare talks about walking through zoos and finding things discarded on the ground that are perfect playtoys for certain species of animals with certain kinds of behaviors or motor skills. For

chimps and other higher primates, TV is often a positive and stimulating distraction, but Hare thinks handlers make a mistake if they just pop in a disk or turn on a show and let the animals watch.

"If the animal doesn't have the option of turning the volume down or even turning it off, I would question how enriching it is," she says. "Think of being stuck in a room with loud music playing that you don't like and you can't get away from." A better solution, she believes, is to teach the ape to use the remote and hand it over.

Channel-surfing, clearly, is not the answer for every suffering animal, or even every suffering ape. But answers are there. For a lot of beasts living among humans today, it may be too late to undo the damage we've done by getting mixed up in their lives in the first place, but at the very least we can mitigate that damage. Going forward, we can think harder about sparing them the experience of being brought into our world at all—and sparing them the pain of losing their minds in the process.

Do unto others: What rights do animals have?

There's no such thing as a good day for an elephant newly taken from the wild. Captivity is a tough adjustment for any formerly free animal, accustomed to trees and brush and forest canopy and suddenly surrounded by bars and walls and brutish humans. But for elephants it may be tougher than most. They've typically been captured for one of two reasons—to work or to entertain—and neither one comes remotely naturally to them.

What's more, they're huge. A male African elephant may grow to a height of 13 feet and a weight of 15,000 pounds, or close to 90 times as heavy as the average, ostensibly superior human who now controls him. That calls for some swift discipline if the captive is not going to kill the captor, and so the captor cracks down fast.

The wild elephant is first tied to several other, already domesticated elephants, which drag him to a training area. The animal is tied or shackled by limbs and neck to trees or a huge wooden frame, which prevent it not merely from fleeing but from moving at all. The animal, no surprise, fights this, which is paradoxically fine with the human captors, because a flailing, thrashing elephant will soon cause itself painful rope burns, not to mention fatigue and profound thirst, all of which weaken it.



HEARTBREAKING BAD

Top: A baby elephant is beaten in Myanmar before being sold to work in the tourist industry in Thailand.

Bottom: Satao was one of perhaps a dozen remaining "tuskers," elephants whose tusks nearly reach the ground. The legendary bull had survived previous attacks but was finally killed for his ivory in Kenya in 2014.





Only after a week or so of such confinement do the trainers begin their work, which usually involves a sharpened metal bullhook, affixed to the end of a long pole and designed to puncture the elephant's skin and then catch and hold. Think of an oversize fish hook snagged through the flesh of your ribs or cheek or ear; then picture someone pulling on it, hard. You'd go where you were told, and so do the elephants.

Bullhooks aren't the only tools at the elephant trainer's disposal. There are whips and electric prods. And, cruelly, there are those other elephants. Over the course of days, the working elephant in training is sent into the field tied to others and trailed by at least one hook-wielding person to learn its new job or, in some cases, to die trying. Infection or a self-inflicted injury that results from flailing and struggling may spell the end. So can a gunshot, if the animal seems about to pose a mortal danger to its humans.

More often, though, it simply gives in. Elephants, as far as we know, are not moved by a sense of indignation or outrage or a basic awareness of rightness and wrongness. They are moved, like all living things, by a basic need to avoid painful or unpleasant stimuli and move

toward pleasant ones. Resistance means thirst and the bullhook and more dragging by other elephants, and surrender means water and food and more freedom to move. The equation just doesn't balance, so the elephant chooses submission, which is why it's called being broken instead of being trained.

If animals were humans, they would rise up—and some do. The odd elephant does crush its trainer; the occasional pit bull does turn on its cruel owner. But they're rogues, and they're rare. Without that missing sense of moral outrage, to say nothing of the organizational capabilities humans have in abundance but animals largely lack, they will always be forced to submit or die.

But humans do have a sense of outrage, even when it's outrage by proxy: the ability to recognize and define a wrong when it's being done to another and be motivated to do something about it. For centuries, there have been animal-rights activists who have argued that the license we grant ourselves to mistreat a member of another species just because of that otherness is indefensible—morally, philosophically, sometimes simply economically.

Their success has always been limited.



BILLIONS SERVED

At the heart of our fraught relationship with animals is the fact that many of us love the way they taste fried, stewed or roasted—and have for hundreds of thousands of years. But whereas once our connections with the animals we killed for food were local and intimate, we now grow meat the way we manufacture iPads and family sedans.

Witness the thousands upon thousands of cows crammed into muddy feed lots, suffocating on the ammonia and other fumes from their own waste while being fed on an unnatural, corn-heavy diet designed to fatten them fast; witness the sharks slaughtered for their fins and the whales murdered for their meat and the roosters and dogs raised to fight and die, to say nothing of the elephants flinching from the hook and the whip.

But what's different now is science. What's different are the things we're learning about animal sentience and inner experience and the fact that they do suffer and dread and experience terror. And with that have come lawsuits, legislation and criminal actions against animal abusers that never would have been possible before. With that, too, has come the improbable animal "personhood" movement, the attempt to assign humanlike right to animals—arising from an almost humanlike status—a proposition that is equal parts thrilling, courageous and at least a little preposterous to some people.

But that's the nature of all rights movements, and like it or not, this one is under way in ways it has never been before. The animals,

which may never be able to comprehend the concept of civil rights, may be about to get some.

Humans have been wrestling with the question of animal rights for a long, long time. Descartes took his famously dismissive, famously mechanistic view of animals as recently as 1641—arguing that while humans have consciousness and feelings, non-humans are little more than biological machines, automata that engage in behaviors but with no awareness whatever that they are doing so.

But far earlier, other thinkers were taking far more charitable positions. Pythagoras, the Greek mathematician and philosopher who lived 2,500 years ago, believed he heard the voice of a dead friend in the bark of a dog. That apparent evidence that animals had humanlike sentience—and indeed, that humans might be reincarnated in nonhuman form—was good enough for him, and he became one of the earliest and loudest advocates for vegetarianism. Around two centuries later, Theophrastus, who was a student of Aristotle, made a similar case but simplified it, believing that animals are conscious and therefore should be kept off our dinner plates. In A.D.



300, the Phoenician philosopher Porphyry made an impassioned argument for vegetarianism and the gentle care of animals in his manifesto *De Abstinentia* (On Abstinence).

So animals have always had their champions, but they've been faced with far greater numbers of people who saw things differently. Human beings, like it or not, are carnivores, and of all the qualities we may see in animals, one of them will always be deliciousness. And while vegetarianism is a nice idea if you're living in a reasonably safe and civilized place and you have the ability to farm or at least gather what you need to eat—and to balance it all so you figure out ways to include plant-based proteins you're not getting from meat—for many civilizations, it's hunt or die.

That's not to say that we have always been comfortable with that hard reality. There's a reason most cooks have stopped serving whole roasted carcasses or, if they do, will at least remove the head before they cook it and bring it to the table. The more you objectify your dinner, the less conflicted you feel about eating it. And as food production has become a major global industry, that practice has become increasingly refined.

"Meat has become more and more bloodless," says Hal Herzog, a professor of psychology at Western Carolina University and author of *Some We Love, Some We Hate, Some We Eat*. "The industry has lowered the disgust factors. They've de-animalized meat. You used to buy a chicken



carcass. You now see packages of chicken fingers, chicken tenders. There are no bones. They are de-animated abstractions."

What's more, even people who are committed vegetarians, if not vegans, must reckon with the fact that farming requires animals. Horses and oxen may no longer be needed to pull heavy loads in most parts of the world, but if you're going to put milk, eggs and cheese on your table, you'll have to press a lot of chickens and cows into involuntary service. The very manure needed to fertilize fields must come from animals, and they certainly don't drop the stuff off at a collection center voluntarily.

All that makes it awfully hard to be an absolutist, though plenty of people have tried. Ingrid Newkirk, the president of People for the Ethical Treatment of Animals, is an advocate of the school of thought best captured in the succinct (and, by most lights, oversimplified) motto "a rat is a pig is a dog is a boy"; in other words, all lives are equivalent lives. The likes of Descartes thought this idea absolute nonsense, and most modern thinkers reject it too, without going so far as reducing animals to machines. British-born professor and philosopher Roger Scruton would deny animals rights because, essentially, they're incapable of feeling the sense of societal obligation and responsibility that ought to come in exchange for them—though that idea sidesteps the question of what to do



ANIMAL PASSIONS
Philosophers may debate the fine points of animal "personhood," but it is usually moral shock that gets us to change how we actually treat animals. A growing awareness that animals suffer—and deserve better—at our hands has long fueled activists who aim to stop the exploitation of animals in labs, dogfight rings and couture houses.

with humans who are equally indifferent to or incapable of their duties under the social contract.

For the huge majority of people, however, the idea gets wrestled with somewhere in the middle: trying to balance what humans need from animals with what animals should be entitled to expect from us. Kim Stallwood, a champion of animal rights and author of the book *Growl: Life Lessons, Hard Truths and Bold Strategies from an Animal Advocate*, goes much further even than most vegetarians and vegans in his devotion to the animal cause, but he makes a very mainstream case for it.

For most people, he believes, it takes some kind of "moral shock" to wake up to the problem, like the one he received 35 years ago when he worked in a chicken slaughterhouse. "The moral shock opens our eyes to animal cruelty," Stallwood says. "We see what has been previously hidden from view. We discover animal exploitation is present throughout our world, in the lives we live, the products we buy and where we work and play."

The average person, of course, does not get that kind of up-close experience with animal suffering, but especially in the wired era, it can come in other ways. The Internet is full of videos of elephant training and abuse. There is similar footage of feedlots and brood crates, and no end of exposés in magazines and newspapers describing the cruelty of them. There's a reason the meat industry campaigns so aggressively for so-called "ag-gag" bills, which prosecute whistle-blowers

who film on factory farms, and it's not because the owners are proud of how the animals are being treated. "The movement and its repertoire of protest rely on fomenting public outrage," says Stallwood. "We want others to see what we now see. We want them to experience their own transformative moment."

But how much advocacy is too much advocacy? Move far enough down the vegetarianism-veganism spectrum and you eventually bump into fruitarians, a sub-subset of the no-meat advocates, some of whose members will eat only fruits and vegetables that have fallen from a branch or vine. Taking food that the plant has not surrendered willingly becomes a violation.

When it comes to animals, the thinking can get equally extreme. Maybe you're not a vegetarian but have switched from red meat to chicken both for your health and because cows just seem a little bit smarter than chickens; plus, you reckon, it's better for the environment. All reasonable choices.

"But say you really believe a rat is a pig is a dog is a boy," says Herzog. "In that case, you assume that a chicken is the moral equivalent of a cow. Well, it takes roughly 280 chickens to equal the amount of meat in a steer. So say you're at McDonald's and you are trying to figure out if it's more moral for me to eat a Big Mac or a Chicken McNugget; the answer has to be the Big Mac because there are fewer animals killed."

This kind of reductionist thinking—what

In 2008, Californians approved a ballot initiative to stop cruel confinement of farm animals by an overwhelming majority vote.

Herzog refers to as “counting souls”—quickly takes you to silly places. Peter Singer, author of the 1975 book *Animal Liberation*, is nothing short of a hero in the animal-rights movement. But Joan Dunayer, author of the 2004 book *Speciesism*, finds his thinking impure because he acknowledges that he values human life—and to a lesser extent, chimpanzee and gorilla life—more highly than that of other animals and considers the death of 3,000 people in the September 11 attacks a greater tragedy than the slaughter of the 38 million chickens that were killed that day. Her reasoning? “[C]hickens are worthier than most humans, who needlessly cause much suffering and death,” she writes.

Extrémism like Dunayer’s may be worse than silly. It may also hurt her own cause and the animals she’s trying to protect, since it allows people who disagree with her to dismiss the animal-rights movement out of hand. Most sensible animal advocates are more measured in how they make their case. Stallwood would prefer to rely on many of the same tools other social movements have used so successfully in the past: education, legislation and lawsuits to prevent certain kinds of abuses. And those incremental steps do appear to be making a difference.

In 2008, Californians approved a ballot initiative to stop cruel confinement of farm animals with an overwhelming 63.5% of the vote. Even in states that don’t mandate such humane treatment, cage-free eggs and free-range beef and chicken are becoming increasingly attractive to consumers, even though they pay a premium for the product. Campaigns against wearing fur have by no means ended the practice, but many people who don’t swear the stuff off altogether do try to sidestep the ethical problem by wearing vintage furs. Some designers limit the fur they do use to just trimmings for larger garments—which is either a useless half-a-loaf if you favor a total ban or a step in the right direction if you are counting souls. And while animals are still used in cosmetics testing, the practice has fallen into disfavor, and many

manufacturers make it a point to advertise their cruelty-free, no-animal-testing policies, which is a big selling point for a lot of consumers.

In 2011 the Institute of Medicine, a scientific advisory group that works with the federal government, recommended phasing out the use of chimpanzees in scientific research. In 2013 the National Institutes of Health announced that it was indeed retiring most of its chimps, and multiple pharmaceutical companies have followed suit.

But there are still, clearly, lines that have not yet been crossed, and may never be crossed. The same year the NIH agreed to be kinder to chimpanzees, three different courts in New York State rejected lawsuits asking that four captive chimps be granted the rights of “legal persons,” including the right not to be held in captivity.

“Isn’t there a different way for you to petition the court for . . . relief,” the judge of one of the courts asked the representatives of the group that brought the suit, “other than attempting to have the Supreme Court . . . enlarge the definition of ‘human-being’ . . . to include an animal?” The question was as much rhetorical as it was legal, and shortly after, the judge handed down his ruling. “The court will not entertain the application,” he said simply.

But the thing is, the court had already entertained it, just by hearing the case. That in itself was entirely new ground for people seeking to improve the lot of animals. It is an indisputable fact that animals aren’t human, that no, a pig is not a boy. And it is equally true that humans have a far greater capacity for love and joy and wisdom than any other creature on the planet. But that doesn’t mean they don’t have those capabilities to one degree or another. And it doesn’t mean they’re not capable of feeling fear and pain and dread too.

“There’s been growing recognition within scientific fields that animals are more than just clocks,” says Stallwood. And there’s been growing recognition among the public that such complex and aware organisms deserve our care and, yes, even respect.



OUT TO PASTURE
While we can't know exactly what animals feel, it's a safe bet this cow is happier than those packed into feedlots.

On the Job

Animals with careers: doing the work that humans can't

skills department. They may be valued for their agility, size, strength, charisma or keen sense of smell, but the gifts of nonhuman species are useful to us thanks mainly to their brains, where instinct and intellect are turned into practical resources that can improve our lives.

They save lives and solve problems. They are athletes, soldiers, hunters, guides, entertainers and health-care practitioners. Ever since humans figured out how to domesticate canines, a practice that scientists believe may stretch back some 33,000 years, we've been coming up with creative ways to capitalize on the unique abilities of our animal brethren. Although their résumés aren't gleaming with advanced degrees or fancy titles, these nonhuman workers certainly make up for it in the special-



SYMPTOM SENSORS

Dogs, the most common species of service animal, rely on their excellent olfactory perception to detect signs of everything from a human's low blood sugar to seizures, allergic reactions and cancer.

UNDERWATER LOOKOUTS

The U.S. Navy's Marine Mammal Program, launched in 1960, trains bottlenose dolphins to use echolocation, or biological sonar, to find and mark sea mines or enemy swimmers.



EQUINE ENFORCEMENT

Police horses are often employed in crowd-control situations, where their sheer size makes them visible and allows mounted officers to survey much larger areas than they could on foot.



HELPING HANDS

Capuchin monkeys, highly intelligent and weighing six to eight pounds, assist disabled people with daily tasks like fetching items, turning lights on and off, loading DVDs and scratching itches.



HERDIC NOSES

Search-and-rescue dogs are trained to detect the scent of microscopic particles that missing humans have shed and to lead responders to their location.

People love dogs and hate rats: what that says about them—and us

You may or may not know who Michael Vick is, but if you do, here's the first thing that probably comes to your mind: he's The One Who Killed the Dogs. Vick wasn't always thought of that way. He is a sublimely gifted NFL quarterback and a first overall draft pick in 2001

who quickly justified that distinction by amassing a string of records, awards and multimillion-dollar endorsement contracts. It was high times for a young man—and then he started killing the dogs.

In 2007 Vick and three others were charged with owning and running a dog-fighting operation with the tellingly ugly name Bad Newz Kennels. Dog fighting is a felony all by itself. But the Vick crew took things further. Dogs that weren't considered up to competitive scratch, either because they were insufficiently aggressive, insufficiently strong or simply lost too many fights, were killed, by hanging, drowning, shooting or electrocution.

For those crimes, the former superstar served 21 months in federal prison. He was cut loose by his team, the Atlanta Falcons, as well as by his sponsors, and went, in what seemed a head-spinning instant, from being a wealthy and admired man to being an out-of-work, universally despised one.

Vick, it is only fair to acknowledge, served his sentence humbly and



without incident, emerged from prison a willing spokesman for the Humane Society (though the group preferred to describe him as a "messenger"), caught on with the Philadelphia Eagles, and won comeback player of the year in 2011 for both his on-field skill and his quiet leadership. And for all that, the first sentence of his biography will always identify him as a dog killer, a reputational stain that even the people who have forgiven him reckon he deserves.

But it's only fair to ask this: Suppose Vick had raised not fighting dogs but fighting rats and had killed them in equally ugly ways? What about chickens? What about alligators? Suppose it were possible to raise fighting hogs and Vick had hanged or drowned a few of them? Would that make any difference compared with the 116 million hogs slaughtered in the U.S. each year, to say nothing of the 9 billion chickens? If Vick ever makes it to the Super Bowl, Americans will eat 1.25 billion chicken wings on game day alone, and those birds didn't surrender their lives voluntarily. So Michael Vick deserves to be known as a dog killer? O.K., but what does that make the rest of us?

The fact is, humans have always had a profoundly bipolar relationship with animals. We love them—at least some of them. We loathe them—many of them. And as for the vast majority of them—the nondescript reef fish or brown sparrow or sea sponge—well, we barely give them a thought.

All that would be no problem if this were just a matter of taste, the way we like some kinds of weather or fruits or flowers and not others, but animals have a profoundly real stake in this game. They can be crowded out or wiped out entirely if they get in our way; they can be eaten en masse if we fancy their taste. Or, oddly, they can be gathered into our homes and communities and pampered like our own young.

Not a lot of animals make that cut, but the ones that do are treated royally. The pet industry is a \$59 billion per year behemoth, a sector of the economy that grew 28% from 2007 to 2012, even during the few years of the recession that began in 2008. There are nearly 150 million cats and dogs kept as house pets in the U.S., or slightly less than one of them for every two Americans.

"The average person munches down on chickens and basically treats them as you would tomatoes," says Hal Herzog, a professor of psychology at Western Carolina University and author of the book *Some We Love, Some We Hate, Some We Eat*. "But we can relate to dogs and cats, as well as the great apes and other large-brained creatures like whales and dolphins. I once asked the philosopher Tom Regan where we draw the line, and he said, 'Well, I draw it in pencil.'"

That kind of vagueness is fine for philosophers and authors—and, for that matter, all the rest of us, who can afford to contemplate and puzzle over our relationship with the animals that share the planet with us. But the more science learns about what animals think, feel and fear, the more we have to wonder if we've been bungling that relationship, missing out on a chance to know them better and appreciate them more.

Is Anyone Home?

A great deal of the way we treat any one kind of animal is determined by what we believe is going on in its head. It's a pretty safe bet that an oyster neither thinks nor worries nor enjoys itself much (though it's impossible to say with certainty without actually *being* an oyster), so we can kill and eat it with impunity. Not so a complex and charismatic critter like a lion or gorilla.

But even the smartest animals haven't always gotten the credit they deserve. There may have been no one in history who was less impressed with the mind of the animal than 17th-century French philosopher René Descartes, who airily and famously declared, "[Animals] eat without pleasure, cry without pain, grow without knowing it; they desire nothing, fear nothing, know nothing." That handy assumption makes it awfully easy to do with animals as you will. If



Suppose Vick had not raised fighting dogs but fighting rats and had killed them in equally ugly ways?

your horse is no more sentient than the plow it pulls, you can dispose of both with impunity. Neither one, after all, is doing any suffering.

But Descartes had his detractors, notably Voltaire, who a century later came to a more compassionate view of animals. Paradoxically, he arrived at that position through his understanding of the decidedly non-compassionate practice of vivisection. "You discover in [an animal] all the same organs and feelings as in yourself," he wrote in 1764. "Answer me, mechanist, has Nature arranged all the springs of feeling in this animal to the end that he may not feel?"

By 1859, Charles Darwin took that thinking a step further, arguing that consciousness and subjective experience in animals moves along a sort of spectrum that parallels their physical complexity—a view that innately feels right and makes a kind of intuitive sense. "[Animal] psychology will be based on a new foundation," he wrote, "that of the necessary acquirement of each mental power and capacity by gradation."

Even then, not everyone was sold, and deep into the 20th century, scientists who were part of the behaviorist school seemed a lot cozier with Descartes than Darwin, reducing animals to a suite of reflexes, instincts and reactive behaviors. Those behaviors could perhaps be shaped by experience, but that didn't mean the beast had learned anything, any more than does a spell-check program when it encounters the same slang word enough times and eventually stops flagging it as an error.

"The behaviorist-school perspective was persistent," says science journalist Virginia Morell, author of the book *Animal Wise*. "I started reporting on animal cognition in 2005, and when people would ask me what I was writing about and I would answer, 'How animals think,' they would nervously laugh, not sure whether I was a flake. All of us were taught not to see thought in animals." But as animal research advanced, that kind of thinking has become harder to sustain. Some of the most remarkable studies have involved animals that we don't typically think of as especially bright: birds.

There's been much made about the ability of

crows, ravens and jays to fashion tools and even appear to intuit what's going on in the minds of other birds, hiding food in one spot when they know they're being observed, for example, and then re-hiding it as soon as they're alone. It's parrots, though, that move us most, not least because they can talk.

Speech is an ability that's easy to overstate, and some of that is mere human vanity. "Our language skill is supposedly exceptional. But is it?" asks Morell. "Or is it just that because we do it so well, we overlook or miss altogether the language-like skills of other creatures?"

What's more, parrot speech is not *de novo* speech but instead is based on mimicry: the bird simply hears things and repeats them. The fact is, however, humans master speech the same way, which is why babies who are spoken to more

begin talking earlier. The key distinction is, for you those words have meaning and for the parrot they don't—except maybe they do.

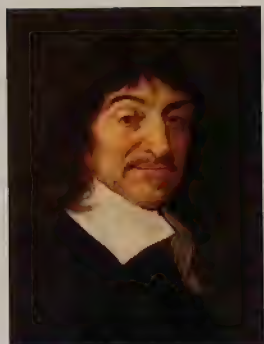
The story of Alex, the famed gray parrot that died in 2007 at age 31 and was raised from chick-hood by animal psychologist Irene Pepperberg, is the go-to case in the matter of parrot speech. Alex knew more than 100 "words," could describe things by color, shape and size, and could identify objects that were part of the same group, even if they looked very different. A key

was always a key, for instance, whether it was big, small, red, green, made of metal or made of plastic. He could also add in a rudimentary way. When Pepperberg made two clicking sounds with an instrument and then two more, Alex would say "four." When she added two more, he'd say "six."

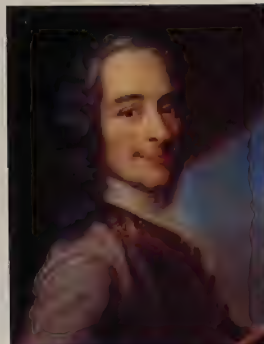
Most evocatively, Alex could also construct simple sentences. On the last night of his life, according to his obituary in the *New York Times* (yes, Alex had an obituary in the *New York*



"Insects evoke a 'strange coldness,' and it's possible they have no consciousness at all."



In 1641 French philosopher René Descartes wrote that animals “eat without pleasure, cry without pain, grow without knowing it; they desire nothing, fear nothing, know nothing.”



By 1764, Descartes's compatriot Voltaire railed against the practice of routine vivisection in medical education on the basis that animals had the same “organs of feeling as in yourself.”



A century later, Charles Darwin argued that the animal world, humans included, revealed not only anatomical and physiological similarities but psychological ones as well.

Times), Pepperberg was covering his cage and he said, “You be good, see you tomorrow. I love you.” He was found dead the next morning.

Stories like that beg to be accepted wholesale—they're just too appealing not to be—but even people who believe in them admit that the case will always be hard to make. “Irene's work has been difficult because she had one parrot for so long,” says Morell. “Who's going to replicate that work? She really lived with that parrot.”

But other scientists are living with other parrots elsewhere, in the wild, and they're finding that the birds' native “language” appears to be almost as full of meaning as Alex's acquired one. Steve Beissinger, a professor of wildlife ecology at the University of California, Berkeley, has set up recorders and other monitoring equipment in wild parrot colonies and has found, for example, that parrots address one another by signature calls that amount to names.

As with humans, they get those names at birth, from their parents, and keep them for life. Adult parrots will often precede a series of vocalizations by calling out the name of one

individual in particular, and only that individual will respond. This is particularly common when, say, a male parrot in flight is returning to the nest and calls out the name of its mate.

“He's saying something to her, maybe he's asking her something, and she will only come up to the call of her partner, her husband,” says Morell. “They call back and forth and he says something more than, ‘Hi, honey, I'm home and I've got food.’ It's probably something like, ‘I have food and I want sex.’ And she's probably saying, ‘Well, I want to eat first. I've been with the kids all day.’” Morell laughs, but she's only partly kidding.

Beissinger's 25-year project is being continued by Karl Berg, a professor of avian ecology at the University of Texas at Brownsville. Berg has made extensive recordings of these exchanges and is looking for repeated patterns that would suggest exactly what is being communicated at any moment, in part by looking at the behaviors that follow the conversation. If he susses all this out, it becomes harder to deny that birds, or at least parrots, are creatures that inhabit their

“You don't say!”



own lives and pursue their own goals, acting and communicating with real meaning. If a parrot recently captured in the wild is squawking in a pet store, can we completely rule out the possibility that it's calling out for the mate it left behind? And if that's so, can we in good conscience buy it, cage it and take it home?

Communicative ability, expressed through speech or squawks or even in silent ways, will always stack the deck in an animal's favor. We'd long assumed that the great apes are smart, but never so much as when Koko the gorilla learned American Sign Language or Kanzi the bonobo learned hundreds of pictograms standing for different words. But the meerkat's chirp-barks, the pigeon's feather fluffing and the elephant's trumpeting are full of meaning too.

The same is true of the fish that shake their heads to signal the start of a hunt and the crickets that chirp in the trees, producing what for us is the nighttime white noise of summer but for them carries meanings like, "My tree, my branch, stay away—except for mates." We live our complex lives on a summer night just as they live theirs.

Love the Lovely

Attraction and revulsion play a big part in our feelings for animals too, and the general rule is, the more they're like us, the better they get treated. Mammals, with their warm blood, familiar faces, characteristic nursing and covering of fur, which we retain to varying degrees, pass a certain threshold test. Other, less similar animals don't. You catch a fish and watch it flop around on the deck of a boat—slowly suffocating—with little thought. But a mouse in a glue trap is probably suffering no more than the fish out of water, yet you're likelier to wince, sweep it into a dustpan, and try to put the whole messy affair out of your head as quickly as possible.

Animals that retain a certain infantile cuteness have a different kind of appeal, one that extends to far more than just mammals. Humans and other species are hardwired to respond with tenderness and protectiveness to animals that display the signature features of babyhood: high, rounded forehead, small nose, big eyes, receding chin, and, in the case of birds and mammals,

downy feathers or fur. In some animals, this so-called neoteny lingers into adulthood, and that pays big dividends.

Rats and squirrels are both urban rodents, but rats have pointed noses, low foreheads, beady eyes and naked tails, while squirrels have higher foreheads, large eyes, blunt noses and fluffy, upturned tails. Yes, rats are aggressive and carry disease and squirrels mostly keep to themselves unless they're hanging just out of reach begging disarmingly for a handout of popcorn or nuts. But it's hard to imagine reacting with anything but a shudder to the sight of an equally well-behaved rat waiting for food or scurrying up a tree trunk.

Pandas, similarly, are just beady-eyed bears, but their black-mask markings expand the appearance of their eyes to infantile size. Their rounded ears and habit of sitting upright don't hurt either. Paint a panda all black and put it on all fours, and we'd care for it a lot less.

One 2009 study published in the *Proceedings of the National Academy of Sciences* went so far as to conduct functional magnetic resonance imaging of the brains of volunteers when they looked at pictures of babies and found that multiple regions associated with pleasure—including the nucleus accumbens and the ventromedial prefrontal cortex—light up, just as they do from other stimuli like food and sex. Related studies have shown that the disgust we experience when we look at a creature like a rat is mediated instead by the anterior insulae, which is also where feelings of nausea are processed.

Snakes possess a special spot in the terror and disgust lobes of our brains. Much of that has been attributed to the early division between reptiles and mammals, which widened as our kind became heirs to the planet. But Herzog thinks some of this may be learned too. "If you look at the most common animal phobias in the U.S., fear of snakes is the number one," he says. "Roughly 50% of people have a phobia about snakes, but 50% don't."

Science backs up what the pollsters find. When toddlers are shown snakes and spiders on computer screens, they react with interest, particularly to the fluid way the snake moves. What



HUMANS ARE SUCKERS FOR CUTE We seem to decide which animals are cuddly, smart and even worth saving by looking at their faces.

they don't show is any fear. But show the same toddler a picture of an adult screaming at the sight of a snake and they quickly learn to feel the same fear. Something similar has been shown with rhesus monkeys, which exhibit no innate snake aversion until another rhesus expresses fear or alarm.

Insects inspire a level of revulsion all their own—one that's always been hard to understand, especially since the overwhelming majority of them are harmless to us and their tiny size means they can be dispatched with a swat or a stomp. Still, as insect ecologist Jeffrey Lockwood observes in his 2013 book *The Infested Mind*, bugs offend our sensibilities in numerous ways. For one thing, he writes, they are nature's ambulance chasers, associated with—and often feasting on—death and decay. What's more, they often carry disease; they can be accidentally ingested or even, in the case of gnats, inhaled; they wander underfoot and can be crushed with a telltale crunch and explosion of ooze. Their very movements seem somehow wrong as well: too quick, too mechanistic, at least compared with



large, slow mammals like ourselves.

"Insects evoke a 'strange coldness,'" Lockwood writes, quoting the Hungarian philosopher Aurel Kolnai, "the restless, nervous, squirming, twitching vitality [that gives] the impression of life caught up in a senseless, formless surging." In other words, yuck.

If all that weren't enough to seal the deal against bugs, there's the very real possibility that, unlike most higher animals, they have no consciousness at all. Nature is famously parsimonious, using the same structures and patterns over and over again at different scales: spirals, crystals and geodesic domes; branching capillaries and branching trees; even the two-eyed, one-mouthed, multi-limbed body plan of so many species. If it's possible to invent an insect that works on autopilot—eating, mating and staying out of the way of trouble long enough to get its genes across to the next generation—there's no reason to give it the ability to be aware of what it's doing. Trees and plants do perfectly well without minds.

Matters could be less simple than they seem,

however. Ants may not think, but, as Morell puts it, "they have these algorithms in their brains" that produce complicated behavior. An entire colony of ants magnifies that complexity exponentially, at some point producing what amounts to a single large organism made up of many smaller parts. Dissections of honeybees—another species that lives in communities that feel almost urban in their complexity—have revealed a brain that is arranged in two hemispheres, very much like our own. "Everything looks so similar," says Morell. "It's a design that works."

Best, Beastly Friends

If our feelings for animals and our treatment for them exist on a sort of pyramid, with the loathsome at the bottom and the loved at the top, dogs and cats clearly occupy the absolute pinnacle. Roughly 90% of people consider their dogs and cats members of the family, according to one poll, compared with just 1% who consider them mere property. Nearly 60% report being "very likely" to risk their lives to save a pet, something that was proven starkly during Hurricane Katrina in 2005, when many New Orleans residents refused to evacuate their homes if rescue boats or helicopters wouldn't permit animals to come aboard.

This display of cross-species loyalty led, little more than a year later, to federal passage of the Pets Evacuation and Transportation Standards Act, which mandated the creation of evacuation shelters for pets during natural disasters and required the Federal Emergency Management Agency to reimburse states for the creation of the facilities. Even in a Congress that is chronically unable to accomplish such things as keeping the government funded and the lights on in Washington, the bill received near unanimous support in the House and unanimous support in the Senate.

"Today, cats and dogs are the most valued and legally protected animals in the country," says David Grimm, author of *Citizen Canine*. "Pets are not just becoming more like people in our laws and homes, they're becoming more like people in our society."

That, as with so many things we fetishize, is leading to excesses and even absurdities. There are no fewer than a dozen pet massage thera-

pists working in Portland, Ore. A doggy day-care center in Baltimore offers orthopedic beds and daily agility classes. Some funeral homes and cemeteries make it possible for owners to be buried with their pets.

And it doesn't stop there. Already, Grimm says, divorcing couples are waging bitter custody battles over pets, with one celebrated case costing \$146,000 in legal fees. Judges, familiar with disposing of animals as property in cases like this, are increasingly being put in the position of having to apply an animal version of the "best interests of the child" rule that until now had been used only in human custody cases.

Veterinarians face a whole different set of challenges. On one hand, their very livelihoods depend on the love people have for their pets. On the other hand, love can be an irrational thing. "Nobody's going to spend \$2,000 to fix a dog or a cat they consider the same as a toaster," Grimm says. "They're just going to get a new toaster."

When it comes to pets, however, they open their wallets. The problem is, owners who pay for human-quality care expect human-quality results, and the specter of malpractice cases looms if things don't work out. That could lead to the same malpractice-insurance spiral that has done so much to drive up medical bills in the human health-care sector.

While dogs and cats enjoy nearly the same kind of fawning attention from humans, it's dogs—like it or not, cat people—that are the greater of the two near-equals. Not only were cats not always loved, says Herzog, until quite recently in human history they were mistrusted and despised. During the New York City polio epidemic in the summer of 1916, a rumor went around that cats were carriers of the disease, and in a single week 70,000 of them were killed by terrified residents. Hard to imagine dogs being dispatched so pitilessly.

"The image of cats was not really rehabilitated until the 19th century," Herzog says. "So the creatures we find so endearing and cute, that's a relatively recent cultural phenomenon."

Dogs hold a higher place, and long have, partly because they understand a simple but exceedingly powerful gesture: pointing. Chimps

can't comprehend it, though some can be taught, and neither can elephants (though cats, dolphins and seals can). To the extent that they and other animals notice the gesture at all, they look at the hand. Dogs look in the direction of the point. And that's huge.

Pointing is a wordless way of sharing information, of one individual saying to another: I am aware of something that might be of interest to you and I want to call your attention to it. From that flows the higher-order concept known as theory of mind: the understanding that your knowledge is uniquely yours, but that you can offer it to another individual. From that grows the reciprocity of a truly complex, truly shared relationship.

"This is something dogs just do," says Brian



TOP DOG
The animals that people keep as pets occupy the pinnacle of human affections.

Hare, the founder and director of the Duke Canine Cognition Center at Duke University. Cats may cuddle and cats may bond and learn quickly to live harmoniously with humans, but dogs partner with us from the start.

None of that means that other animals, both the loved and the loathsome, don't deserve some of the regard that we offer dogs. Yes, it's the rare person who will care for a pig or a pigeon or a fish with any true depth. But awareness of animals' inner lives, their private worlds—the fact that they have such worlds at all—ought not to be too much to ask. "It comes down to realizing that animals have places to go and things to do," says Morell. If we can't share those things with them—and in most cases we can't—we should at least get out of their way.

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Ingo Arndt [*Animal Architecture*] is an award-winning wildlife photographer based in Germany.

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